THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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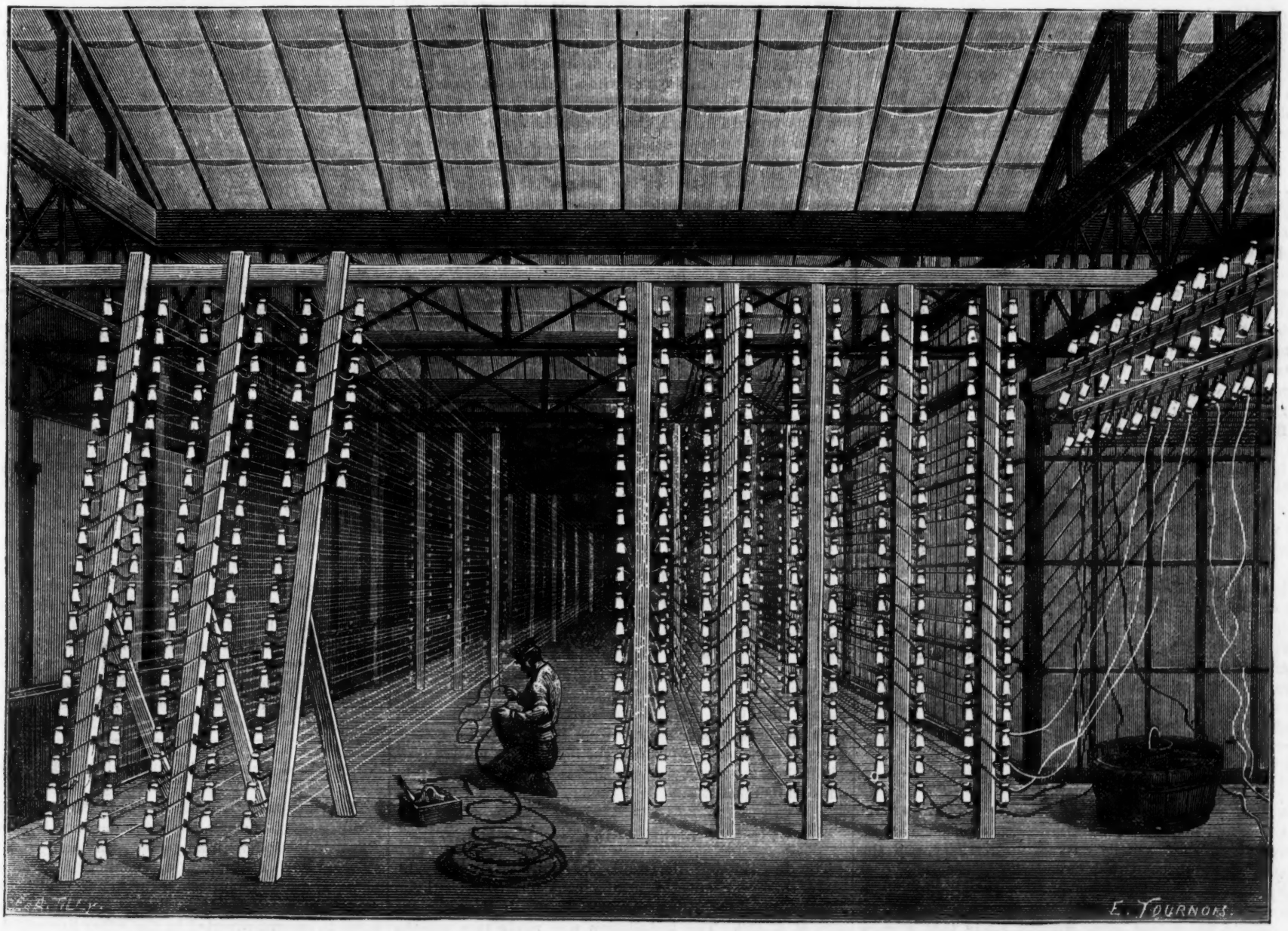
A Large Rheostat.

In many instances electricians require to introduce into a circuit a certain amount of artificial resistance, in order to compensate for some piece of apparatus cut out of circuit, or else to make the current vary to a desired degree. Sometimes, also, the resistance of an electrical apparatus is to be measured, and it is equally necessary in such a case to have standard resistances of known value, for the purpose of making comparisons whereby the unknown resistance may be determined with precision. As the artificial resistance required for substitution or comparison may be almost infinitely small or extremely great, the standards used by electricians require to be divided into convenient portions both large and small. For this reason an arrangement called "rheostat" is used. A rheostat is, in fact, merely an apparatus containing resistances with devices whereby any desired portion or amount of resistance may be available. Thus, when a current passes between two plates immersed in a liquid, the resistance may be varied by changing the distance between the plates. This constitutes a crude rheostat. But this method is not accurate, because it would be difficult to measure the distance exactly, and, besides, the temperature would affect the specific resistance, while the polarization produced by the passing current itself would also be a new source of error. If we take a wire of igven length, whose resistance is accurately known, then one-half of the length, or any portion thereof, represents a corresponding portion of the total resistance, since resistance increases in direct proportion to the length when the wire is of uniform diameter.

The rheostats ordinarily used by electricians are more convenient than this, however. They consist of coils of wire, of different lengths corresponding to the resistance they represent. These coils are grouped together in a convenient box, on the cover of which are devices for controlling the amount in circuit. Usually the coils are all connected together in series, and from the point of junction. A short connection goes to a contact button on the box cover. The buttons are close together and so arranged that a metallic plug can can be inserted between them, as in the ordinary telegraph switch-board. When the plug remains inserted, the coil whose ends are connected to the button on eacn side is short-circuited and consequently when all the plugs are inserted, the resistance of the rheostat is zero; the resistance desired may be included into the circuit by the simple operation of pulling out the plug corresponding to the coil of that resistance, the resistance of each coil in ohms or fractions of ohms being marked opposite each plug.

In making rheostats all possible sources of error are avoided. When a current is passed through a coil of wire, for instance, the induction between the contiguous turns of the wire produces a variation in the electromotive force. In order to obviate this induction, the wire of each coil is bent upon itself before being wound, so that the inductive tendency of one-half may be exactly counterbalanced by the contrary tendency of the other half. In order that the number of turns required for a given resistance may be less, the wires used are made of metals or alloys possessing great resistance. Thus, with platinum the wire would be nearly seven times and with German silver over eleven times shorter than with copper wire of the same size. German silver is generally used for the resistance coils. It is well known that the resistance is also greater when the wire is of smaller diameter, and for this reason the wire used is very fine. The use of fine German silver wire permits the construction of rheostats occupying a very small space, thus securing portability and convenience.



RHEOSTAT USED BY THE COMMITTEE ON MEASUREMENTS AT THE MUNICH EXPOSITION.

The resistance per foot of No. 40 wire of a given metal is over a thousand times higher than that of No. 10 of the same metal, and the length of such wire required would be so much less. But there is a limitation to the size of wire which can be used and it is the strength of current which is to be used in each case. The passage of current in a conductor gives rise to heat, and when the current is too strong the conductor becomes unduly heated. By increasing the size of wire used, its capacity for carrying current is increased and the heat is not so great at any one point. With powerful currents therefore it is necessary to use large wires. Thus, while a relay wound with No. 30

wire would not become appreciably heated in a telegraph circuit, it would perhaps be burned instantly if included in an electric-light circuit. The magnets used in dynamo-electric machines and in electric lamps are always made of wire of sufficient capacity to carry the current safely, and the larger the volume of current maintained in the circuit, the greater must be the size of wire used.

Our front page illustration, reproduced from *La Lumière Electrique*, represents a large rheostat or, resistance box, as rheostats are often termed. This rheostat is probably the largest ever constructed, and emphasizes in a strong manner the great contrast between a rheostat applicable to telegraphic and telephonic requirements and one adapted to electric light measurements. The rheostat here illustrated was that employed by the Committee on Measurements at the Munich Electrical Exposition, and was intended especially for strong currents. By means of this rheostat the current from a dynamo-electric machine could be suddenly diverted from its normal circuit through electric lamps, motors, etc. and passed through an equivalent resistance.

This gigantic resistance box, which occupied one of the galleries above the laboratory, was 60 metres (nearly 200 feet) long. The wires were supported on porcelain insulators which were fastened to the vertical beams of a frame extending from one end of the gallery to the other, only a passage-way being left in the centre to render the access to the wires more convenient in case of accident to any of them. The wires passed down below to enter one of the two large rooms which constituted the laboratory where they were connected to three switch-boards. The first switch-board was for the fractional parts of the unit of resistance. The ohm is not so generally used for a standard of resistance as the so-called Siemens unit, which, however, approximates very closely to the ohm, being only a little smaller, or .9536 of the ohm. The smallest resistance was .01 of the Siemens unit. The first switch-board contained five loops; one of .01, two of .02, one of .05 and one of 1 Siemens unit, its total resistance being therefore 2 Siemens units. These loops were of twisted copper cables of large diameter, so that they would not heat with the strongest currents. Each loop was nominally short circuited by a small hand-switch. The second switch-board contained six loops, which made a total of 20 Siemens units (5, 5, 5, 2, 2, 1). The wire was of iron 4½ millimetres in diameter (about No. 5 B & S). The loops were short-circuited in this case also, and when the switches were all in line no resistance was included in the circuit. From this switch-board the connection was made to the third, which comprised ten loops of 10 Siemens units each, the wire being of 3 millimetres diameter (about No. 8½). The contact buttons between the loops in this case were disposed in a circle. and by turning a radial switch lever in the centre of the circle so that its outer end would touch the next contact button the resistance was introduced by tens. The first contact button was connected with the second switch-board and the pivot of the lever formed the outer end of the rheostal circuit, so that when the switch lever touched the first button none of the loops of ten units were in circuit. On the other hand, when the switch lever touched the last button all of the ten loops, or 100 units, were included into the circuit. It is evident that as the switch lever passed from one contact button to the other the circuit would be opened. To prevent the evil consequences which this sudden release of the load on the dynamo-electric machine would produce, the switch lever was made of two positions, one position being moved into contact with the next button and the other being then moved, so that the circuit always remained closed.

It is seen that by means of this huge rheostat the resistance in the circuit of a dynamo-electric machine could be varied from .01 to 122 Siemens units. As the normal circuit resistance of dynamo-electric machines is usually much below this number, the required scope for all measurements was obtained.

What Inventors are Doing.

In an article that coincides very much with our own recent remarks, the *Western Manufacturer* says:

Inventors are now chiefly busy with electricity, and the Patent Office is deluged with devices for making new uses of the modern marvel, or for using it with new appliances. Many of these inventions run in the direction of motors. The opinion has gained some ground lately that storage batteries of electricity are not as successful as was at first expected. It is asserted by some that no storage battery ever gives out as much electricity as it receives, and that every moment decreases the amount yielded. Edison says the best storage battery is a ton of coal, which can be used at any time to drive a dynamo machine. Others, however, still think that the storage battery will produce wonderful results. Inventors have always sought to utilize the forces of nature for the conserving of power. A good deal of time and money have been spent on efforts to utilize the force of the rise and fall of the tide. According to some plans the water is to be stored in a reservoir at high tide, and used to turn a water-wheel when the water falls. Another plan is to get the power from the rise and fall of a float. There used to be a tidal mill at Astoria, and another at Charleston, S. C. The large amount of land required to get the requisite area of water surface is considered an insuperable objection to tidal mills.

Æsthetics of Electric Lighting.

"Practically there is no limit to the number of forms that may be utilized in the stands, chandeliers and brackets for supporting electric lamps."

Vice-President Johnson, of the Edison Electric Light Company, was dilating upon his favorite topic, the æsthetics of electric lamp making. "This is the primary fact to be considered," he said to a *Tribune* reporter last week, "that the light does not require to be placed in an upright position, as must always be done with lights that consume air in burning. The little glass bulb containing the glowing coil may branch in any direction from the stem to which it is attached. That is the point where we began in developing the business of making fixtures for electric lights. The necessities of the gas-jet restricted invention entirely to a small series of variations, and these had been exhausted long before the electric light came into existence. An endeavor to enlist the capital and skill employed in the work of making gas fixtures proved unsuccessful, and then a company was organized to carry out the improvements possible with the new system of illumination. The work of the company has now increased to such an extent that it employs four hundred hands.

"At first the desire was to attract the popular fancy by means of elaborate and ornate designs. There, you see, is a specimen from our European exhibition, a flower-pot overgrown with a wilderness of foliage all done in polished brass. The lights spring from among the leaves like flowers from their stems. While such forms were well enough for an occasional public exhibition, they were found to be unsuited to any other purpose. Men of wealth who wished to have the electric light in their houses wanted the supports to unite elegance with simplicity. The highly ornate plans of the English workers in brass had to be thrown aside. But the idea of treating the glowing bulb as the stamen, which was the first to occur to us, has, however, been retained through all the changes that were made to meet the requirements of popular taste. It was Mrs. Edison who suggested these floral forms as the best adapted to our purpose. We have not varied the discovery yet to the extent that we shall have to do in the future, but have confined ourselves to flowers whose general shape is that of a cup, such as tulips and lilies. But we can as easily use the rose with its multitude of petals.

"Our æsthetic tendency did not receive much encouragement in the demaud for electric lights in factories. Utility and simplicity was the rule of those places, and such was the work required of us in the greater number of cases. But the beauties of the light itself are not quickly exhausted. Look at that 'umbrella light,' as we call it, with its lamps arranged in a circle directly beneath a shining reflector. Or watch that chandelier after I set this little motor to going."

Instantly the lights began chasing each other around the electrolier, at first slowly and then with such rapidity that they seemed two whirling circles of flame. As a matter of fact the effect was produced by the simple device of lighting and extinguishing all the lamps of the series in instantaneous succession. "Even with a switch," continued Mr. Johnson, "some fanciful effects can be produced, such as alternating the lights suddenly.

"By combining the gas jets and the electric lights on the same stem, as we are now doing in some patterns which we are making, the advantages of both systems of lighting can be secured, but the two lights never can be so treated as to produce a harmonious effect upon the eye. An example of the method followed in the combinations is this bracket with the gas jet rising at the top in the midst of a partly opened flower, and the electric lights hanging downward, one of them being an unopened bud.

"But the handsomest device that has been thought of is a hanging framework of brass, in which the lamps are so placed that their stems form a basket that may be filled with artificial plants and flowers in the natural colors. There is no danger of burning the flowers, no matter how slight their structure, and the lights seem to spring right out of a bouquet."

Electric Lighting in New Zealand.

The New Zealand Electric Light and Power Company early this year entered into a contract with Lyttleton Harbor Board for fitting up a 16-light Brush plant for the sum of £1,000. The installation was made two months since. It consists of sixteen Brush arc lights, each of 2,000 candle-power, erected on the works surrounding the inner area of the harbor. Three of these are at the graving dock, two on the steamers' wharf, four on the Gladston pier, and the remainder distributed singly on the various other wharves. Each lamp is fixed upon a kauri post about thirty feet in height. The dynamo is lodged in a compact little building, constructed of iron and match-lined, adjoining the end of the dock engine house. Steam is supplied to the engine by one of the boilers of the dock-pumping machinery. As a matter of course, the inauguration of the lights was the occasion of considerable feasting and toast drinking, the Lyttletonians evincing interest in the new system of of lighting, which was a decided improvement on the old gas lights. The first negotiations for the introduction of the electric light into Lyttleton were carried on by Sir Julius Vogel, as the representative of the Australian Brush Company.

Progress of Electricity in Philadelphia.

Latest reports from Philadelphia show an increased activity as regards the various applications of electricity there to public convenience. Councils' committee on police and fire-alarm telegraph received from a sub-committee on the 4th a negative recommendation on the ordinance permitting the Goebel Sectional Electric Underground and Delivery Company to lay conduits and wires on certain streets. Mr. Cuming objected that the company had not been afforded a hearing, and the ordinance was referred back to the sub-committee. Another sub-committee made a favorable report on an amendment to the ordinance of March 20, 1883, making the annual license charge $10 per running mile on conduits not exceeding 2½ inches in diameter, $20 on 12 inch and $40 on all larger sizes. A favorable report was ordered on a supplement to the ordinance of April, 1883, allowing the Metropolitan Underground Company to extend their line on Market street, west of Thirteenth, to county line, provided they pay the usual amount of $50.

An ordinance was approved granting to the Underground Electric Light and Power Company the use of certain public gas lamps on the south side of Chestnut street between the Delaware and Broad street, for the purpose of testing their light, provided that the gas connections be not disturbed.

The ordinance submitted by William Lantz on behalf of the American Magneto-Electric Light Company, of Germantown, was thought by a sub-committee appointed to consider such bills to be defective and insufficient and was handed back to Mr. Lantz for revision. Several similar bills were laid over because no one was present to represent the companies asking for privileges.

The Portrush Electric Railroad.

The formal opening of the Portrush Electric Railway, which took place on the 29th ult., must be regarded as an event of considerable importance, not only in the history of Ireland, but in the progress of electrical industry. The railway from Portrush to the Giant's Causeway is remarkable as being the first long electric tramway in the world. It is over six miles long, and has cost £45,000, which had been raised by a company formed in the country. The line, after passing through the principal streets of Portrush, follows the seaside road, a footpath six feet broad being reserved for the railway. The gauge is only three feet, and the gradients are very steep—in places as much as one in thirty-five—and in parts of its course the curves are sharper than might have been desirable had the route which it takes been chosen by the engineers. The force to work it is generated by a waterfall in the River Bush, with an available head of twenty-four feet, the electric current being conveyed by an underground cable to the end of the tramway. The water power passing through turbine water wheels, which utilize the whole force of the fall, is said to amount to ninety horse. It is obvious that for a light train of tram-cars there is enough and to spare. The practicability of such a line is now a settled matter. The only question is whether it is likely to pay as a commercial venture. Considering that the initial power costs nothing and that coal in Ireland is dear, there are good hopes that a line certain to be freely used by the continuous stream of tourists always going between Portrush and Bushmills, on their way to the Giant's Causeway, will satisfy the expectations of its projectors.

The Lord Lieutenant opened the road. Among those on the cars were Sir William Thomson (Glasgow), Sir Frederick Brummell and a representative from Dr. Siemens, besides other eminent scientists. Having arrived at Bushmills, where conveyances were in waiting, they were conducted to the Walmill to inspect the works at the Fall, where the electricity is generated. They then drove to the Causeway Hotel, where they were entertained at a private luncheon.

Combined Telephonic and Telegraphic Circuits.

There are many situations where a telephone line runs parallel to a telegraph line for a distance long enough to allow induction to take place. In many cases, for instance, two distant points are connected together by telephone and telegraph lines both, and in addition to the induction between the two wires, the current on one line is liable to become diverted by the other line which then behaves as if it were the ground circuit. This is especially the case when the distance between the stations is comparatively short and when the resistance of the ground is rather high. The remedy is to use three wires two of which are used for the telephone, and the other, with the ground, for the telegraph circuit.

As we are aware that many of our readers are constantly experimenting in this line, we are induced to give an account of a case which was recently submitted to our attention, and which is particularly interesting from the rather original solution which it presents. There were three stations, *A*, *B*, *C* (Fig 1), the distance between *A* and *B* being about 350 feet, and the distance between *B* and *C* being about 200 feet. The three stations were provided with telegraph apparatus as shown in the diagram, the grounds being at *A* and *B*, and a metallic circuit being provided between *B* and *C*. Our correspondent being desirous of establishing telephonic comm unication betw

A and *B* another line *c* was run between *A* and *B*, for the telephone and the ground was used as return circuit, the connection at *b* in the figure being made at 5. On connecting 1 and 2 at both switch-boards for telegraphing, the current was so weak with five cells crowfoot that the sounders did not work. On connecting 3 and 4 to close the telephone circuit also the current was stronger. This is because instead of being obliged to pass through the ground returned through the telephone line, joined with it at the switch-plate 5. On connecting 3 with 5 now the resistance of the telephonic apparatus was pratically short-circuited. The wire *c* formed a return ground, and the telegraph worked well. On the other hand, with only 3 and 4 connected for telephoning, the transmitter and receiver worked well while the magneto bells failed to respond though when *E* 1 and 2 were also connected they would ring. This was due to the diversion of the current from the crow-foot battery. Reasoning that the trouble was from deficient ground connections (which were made of heavy sheet-iron 18×44 inches connected with copper wire No. 12 and soldered at both the plate and switch-board and buried nine feet deep), we made suggestions tending to the improvement of the same. An additional ground connections at *A* of stove-pipe connected to the ground

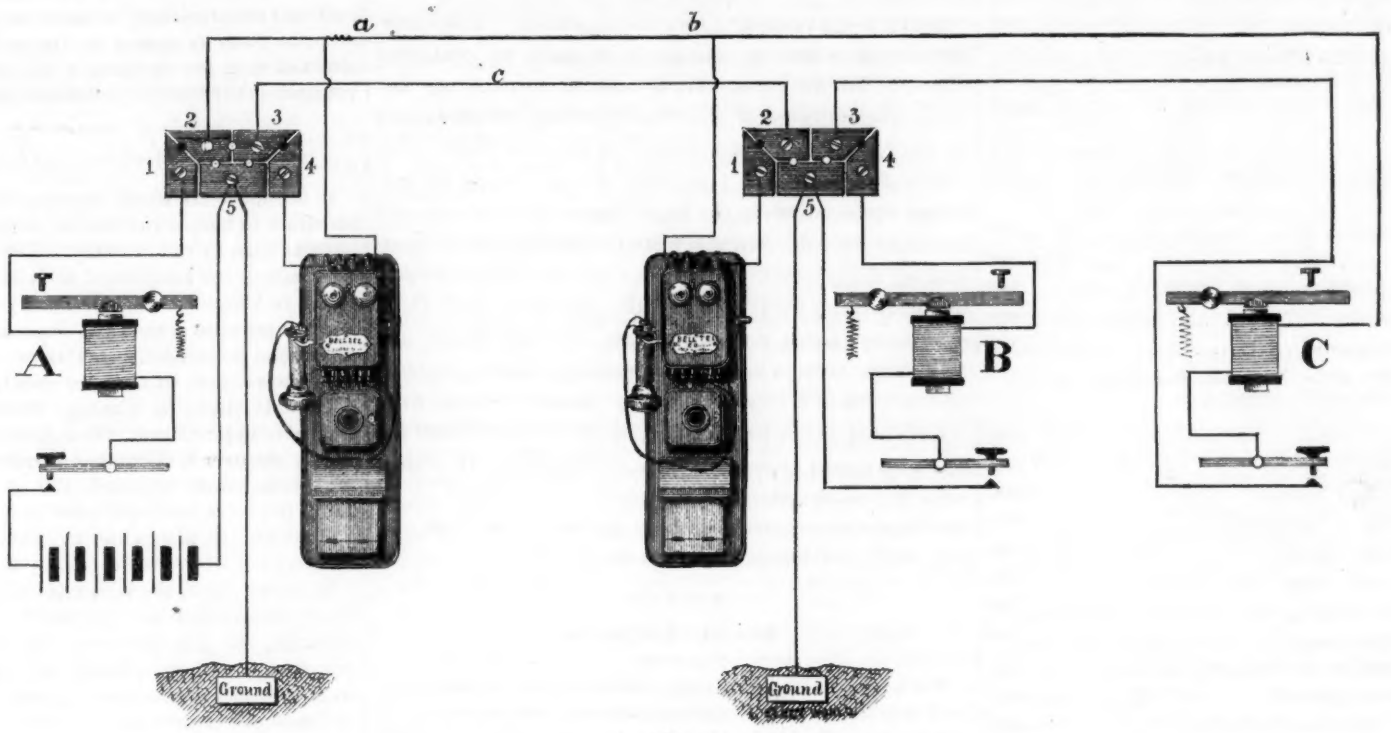


FIG. 1.

plate was placed in awell 40 feet deep. At *B* a 1 inch iron rod was driven down 8 feet in the bottom of the cellar. It was found then that with six cells the telegraph could be operated satisfactorily. To prevent the diversion of the current by the telephone line we suggested the use of the telegraph line as a return circuit for the telephone. Fig. 1 shows the manner in which this was done, the telephone being connected to the telegraph line at *A B* In this situation the telegraphing current would tend to divide at *A* and *B* to pass through the telephone apparatus, but as the resistanee of the portion *A B* (No. 11 galvanized iron wire being used) was under two ohms while that of the telephonic apparatus was several hundred, the amount of current derived in this way was inappreciable. At any rate the operation of the telephone was entirely satisfactory and it was free from the disturbance due to the diversion of current when "Morse" was being sent over the telegraph wire.

It is evident that this idea of using a telegraph line as the return wire for a telephone line strung on the same poles might be applied even were the distances much greater. In such a case the tendency to diversion of current into the telephonic apparatus would be greater because the resistance of the portion *a b* used as return conductor would be much greater and the difference between it and that of the telephone less, but this tendency might perhaps be connected, or at least mollified by introducing an artificial resistance into the telephonic line proper. As being of further interest in this connection we must refer to the two other methods of arranging circuits, where the telephone and telegraph are to be used in conjunction as above. These methods are both due to an Italian electrician, Sigñor A. E. Cruti, and we find an account of them in the proceedings of the Royal Academy of Science of Turin.* The first of these, Fig. 2, consists in causing a counter induction at a certain point whose electro-motive force equals and neutralizes that produced all along the rest of the line. Thus when the telegraph is being used, an impulse of current in the direction of the arrows *a a* would induce an equivalent impulse in the opposite direction *b b* in the telephone line as shown by the arrows. Now, if the telephone line is looped in the manner shown a *b* the inductive action of *a* will be exerted more strongly on the portions of wire nearest to *a*, and the electromotive force of this induction will oppose that in the rest of the line because the loop is crossed. The best method of applying this idea is to use an induction coil (*c*) making the telegraph circuit pass through one coil and the telephone through the other. The induction coil must be so made and so connected that the induction will exactly oppose and neutralize the induction produced elsewhere on the line. It is plain that the operation will be equally satisfactory no matter in which direction the impulses are sent on the telegraph line.

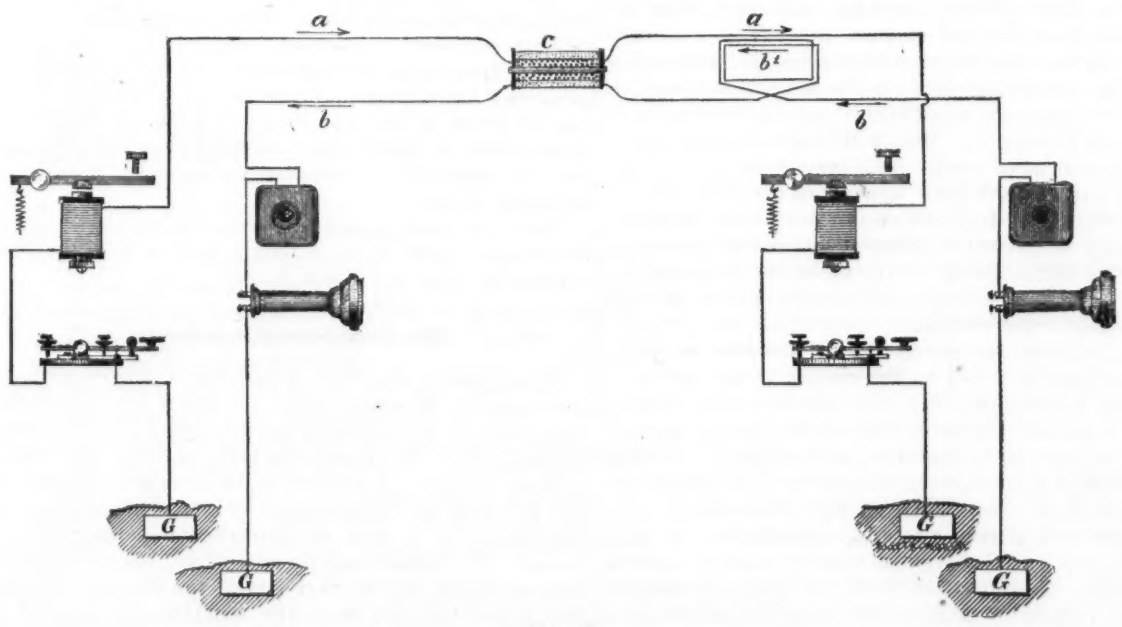


FIG. 2.

FIG. 4.

The second method proposed by Signor Conti is shown in Fig 3.

In this case the telephone is of peculiar construction, such that no secondary coil is needed for the transmitter, or for neutralizing the induction, the wire on the telephone answering the purpose of both. The telephone bobbin, as shown in Fig. 4, is made double, one coil being connected to the transmitter (*a b*) as if it were the primary of the coil in the Blake transmitter, the other (*c d*) corresponding to the secondary being connected to the two line wires. The connecting wire *e* is connected with the last named coil at the centre, so that the resistance of this coil is divide equally on either side of this connection. On referring now to Fig. 3, where *d' d'* are the diaphragms of the telephones, the connections will be understood. The coils (*a b*) of each telephone are included in circuit with the transmitters *t t* and local batteries *p p* the current impulses induced on speaking above end are conveyed by the metallic circuit *c d* to the other end where they act upon the telephone diaphragm. The telegraph apparatus *m m* is connected to the midway connections *e* of each "secondary" coil on the telephone magnet, and as will be readily understood from the diagram, whenever the two wires *c d* practically form a two-branch circuit through which the current from the telegraph battery divides equally on its passage from one telegraph station to the other, and since the current enters or leaves the secondary coils at the centre, and passes in different directions through both halves, no magnetic effect at all is produced on the magnet of the telephone, and the diaphragm is not disturbed. Thus, the two circuits may be operated independently of each other. It is clear that instead of the telegraph apparatus another telephonic apparatus may be used. The same thing may also be said of the two methods just described. They are just as applicable to the case where two telephone circuits are suffering from mutual induction, as in cases of telegraphic interference like those specified above.

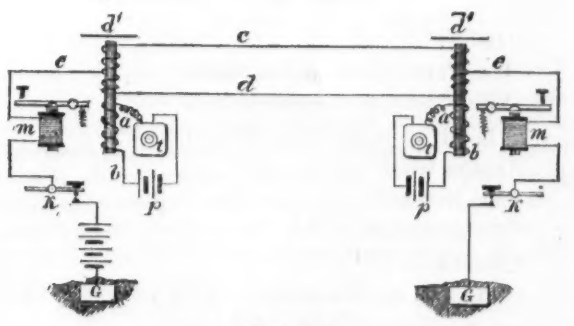


FIG. 3.

*Attidella Reale Accademia delle Scienze di Torino, Vol. XVIII.

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A TELEPHONIC PROBLEM.

"Hello!"

"I can't hear you. Speak louder."

"Come closer to the transmitter."

"'Is this an orphan inn,' did you say?"

"Mister who?"

"Mr. Norton?"

"Please spell it."

"N-o-r-d-a-n?"

"Oh! 'Is Mr. Morgan in?' Well, you needn't get mad about it. Wait a minute. I'll inquire."

The foregoing will be recognized by habitual users of the telephone as a little comedy, the like of which is being enacted hourly all over this broad land. Its purpose here is to illustrate the fact that the telephone, great as has been its progress in seven years, is yet far from being a perfect instrument. The introduction of the carbon transmitter, rendering it unnecessary to hold the lips close to the diaphragm in speaking, was a great advance, and much has been done in extending the limits within which the telephone can be used and in facilitating the making of connections between exchange subscribers, but the voice that is heard in the ear-piece is as faint as it was in 1876, and however closely the instrument be pressed to the ear and however the attention be strained, it is often difficult to distinguish the words of a speaker who may not be five miles away.

The problem of loud-speaking telephony is the most pressing one in the telephone field to-day, and the one most worthy of the attention of inventors. It ought to be no more necessary to hold the ear-piece against the ear than it is to hold the lips against the transmitter, and no doubt the time will come when the voice emitted by the ear-piece will be as loud and clear as, if not louder than, that of the speaker at the other end of the wire. Electricity is so greatly under our control that, having once converted our atmospheric vibrations into electrical undulations, it would seem, *a priori*, that we ought to be able to increase or diminish their strength without much difficulty; but the fact that seven years of telephony have led to little or no improvement in this respect is evidence that the problem is not so simple as it appears. It is encouraging, however, to remember that a similar difficulty met Morse in the early days of the telegraph, and was most happily overcome by the invention of the "local circuit." This example should stimulate telephonic workers to continued efforts in this direction. For the rest, it is safe to say that the successful inventor of a loud-speaking telephone will be forever placed beyond the fear of physical want.

The American Bell Company, we are happy to say, seems to be alive to the importance of this subject, and inventors have devoted much study and thought to overcoming the obstacles involved. Indeed, within the past few weeks, the electricians of the American Bell Company have carried on experiments between Boston and New York with a new long-distance telephone, which is said to work in a very satisfactory manner. Some little defects have yet to be remedied, but it is stated that the new instrument promises to give good results. If it does what its inventor thinks it is capable of, we hope to be able to publish a good illustrated description of this new long-distance telephone in a few weeks.

Electric Æsthetics.

Not so very many years ago, decorative art in the household was neglected and almost unknown, outside a few select circles. To-day it is with a large number of people who have wealth the chief concern of their lives. The homes of the rich are at once museums of the curious or antique and palaces of the artistic; while even in humble dwellings the new cult has its shrines and devout worshippers. Notable artists consider decorative design to be worthy the best efforts of their brush or pencil; authorities, dogmatic and critical, lecture the Philistine public on the need of and the means for obtaining true art culture for domestic application; and handbooks by the score are published giving directions as to the most approved methods of building, furnishing and adorning the House Beautiful. As might be expected, this renaissance of interior decoration has carried away some weak-headed enthusiasts, but it has a good side, and all who rejoice in an expanding civilization must welcome this pleasing sign of the times.

Thus far, however, very little has been said about the incandescent or the arc electric light as a decorative agent. In fact, our own recent articles on the subject, elaborating the useful suggestions of a foreign contemporary, are the first that have appeared in this country treating it seriously and practically. More will be heard on the matter as the electric light companies advance upon their predestined territory and learn how varied are the conditions and circumstances under which this new means of illumination may become, at no distant date, highly ornamental in and of itself, as well as a favorite accessory in the production of brilliant artistic effects in the house, the theatre, the hall or the church.

For examples of the graceful forms that may be given, for decorative purposes, to the electric lamps and their standards, we refer our readers to the excellent remarks of Mr. Johnson, Vice-President of the Edison Electric Light Company, to be found on another page. As that well-informed gentleman tersely put it, "The beauties of the light itself are not quickly exhausted." Gas has never been regarded as truly ornamental. Bigoted æsthetes, if we do not err, condemn it roundly, and its most flaring, dazzling effects strike the ordinary observer as rather vulgar. Nobody would dream of describing it as the "radiant sister of the day," but to most people that happy phrase would seem fairly applicable to the electric light. Then an insuperable objection must be brought against gas: it is very destructive. Long ago it was discovered that the use of gas injured pictures and other works of art. In his charming work on "The Library" Mr. drew Lang tells us: "The book collector must avoid gas, which deposits a filthy coat of oil that catches dust," and Mr. Blades, the eminent English bibliographer, found that three jets of gas in a small room soon reduced the leather in his book cases to a powder like snuff, causing the backs of the books to break away in his hand. Next to gas come, as modern illuminants, oil, tallow and wax. The first has its dangers, not inferior to those of gas, and it is responsible for many rapid passages into the great beyond. Tallow is cheap but malodorous, and the use of wax is necessarily confined to the few who can afford to bask in its soft, silvery rays. But whether it be gas, oil, tallow or wax that is applied to the home or the place of public resort, in each case the variations in the shape of the gaselier, chandelier or candlestick are sadly restricted; and when a comparison of their light is made with that given by electricity, the superiority of the latter as cheerful, pleasing and ornamental will be seen at the merest glance.

Of course in factories, mills, railroad depots, ferryboats, ocean steamers, etc., the prime requisite of electric light is utility, but even in the most humble applications, far greater beauty belongs to it than to the lights that it supersedes. Its effect, too, on the workers and their work is highly spoken of, and in this indirect way it becomes civilizing and refining. We are not of those who rouse Matthew Arnold's ire, by looking upon railroads, cheap post and electric lights as marks of the Millennium, but we do prize them as means to the end of gratifying the instinct of man for expansion and affording him the conveniences that enlarge and secure his existence.

The Electric Light in Europe.

It occupies no small amount of our time, space and attention to keep a full record of the extending use of the electric light in this country. Every day some additions are made to the long list of the cities, halls, mills and other places in which the electric light plant has been installed, and the promise is that the increase is to be even more rapid than at present. In Europe, meantime, in spite of the conservatism that moves slowly alike in physics and politics, the light is gaining ground and enjoying more and more appreciation. Our European exchanges, scientific or otherwise, abound in paragraphs recording new installations, and although the stocks of the companies doing the work have not been sustained at the late high quotations, the mania and the panic have been succeeded by practical work that is telling on the public already.

In Amsterdam, the telegraph offices are now lighted by five Siemens differential arc lamps, of about 36 carcels each, replacing 45 gas burners. At Stockholm some of the principal streets are illuminated by 12 Pilsen lamps, fed from a Schuckert 12-light dynamo machine, driven by a 10 horse-power nominal portable gas engine of Swedish make. The local newspapers are better pleased with the Pilsen than with the Brush, Siemens, Jurgunsen and Jablochkoff lights. The new Italian ironclad, "Italia," is to be fitted with five electric search lights of 1,600 carcel power, and two of 200 carcel power for boat use. Electric light fittings have been supplied to new theatres at Edinburgh and Amsterdam, and an extended use of the light is to be made in the galleries of the Dundee Fine Art Exhibition. The Birkenhead folk have been highly pleased with an exhibition of the light on board their ferry boats, and the Local Board of Padstow, Cornwall, and the Taunton Town Council are setting an example to the West of England by calling for electric light tenders. At Hull a large dock is being excavated by 2,800 men, with the aid of the light, and the contractors for the new Blackfriars railway bridge, London, are resorting to the same means to facilitate their operations after dark. Crossing to Ireland, we learn that in Limerick, the firm of Messrs. Shaw & Sons, who have had the light only a few months, are so pleased with it, that they are increasing their plant by 100 additional Swan lamps. A new factory in Cork is lit up by 150 Swan lamps, and Messrs. Harland & Wolff, the shipbuilders of Belfast, have adopted electrical illumination, by putting in 28 Crompton arc lights and upwards of 200 Swan lights.

These few gleanings serve to show the increased use of the electric light all over Europe, and to indicate what will be its vogue in the near future.

The Incandescent Conductor.

As our readers are aware, a question of priority as to the invention of an incandescent conductor for an electric lamp, formed of carbonized paper, has been pending at the Patent Office, the disputants being Sawyer and Mann against Edison. A decision in the case was rendered on the 8th inst. at Washington, by the Commissioner of Patents, and it is final so far as the Patent Office is concerned. Mr. Edison loses the case there, but he can, if he desires, appeal to the Secretary of the Interior. Should that resort fail, the Secretary upholding the decision of the Commissioner, Mr. Edison can then bring the matter before the judges by filing a bill in equity to compel the issuance of a patent to him in any United States Circuit Court.

The question is an important one, as a contrary decision would have given to Mr. Edison the sole control of the manufacture of carbonized conductors. Paper is now the only substance of which the conductors are made, not covered by his patents, which relate to conductors made of carbonized bamboo, willow, etc.; and this adjudication annuls his right to a patent for an incandescent conductor of carbonized paper.

The history of the interference is as follows: This decision reverses the decision of the Board of Examiners-in-Chief made July 28, 1883, by which priority was awarded to Edison, and affirms the decision of the Examiner of Interferences in favor of Sawyer and Mann, rendered on the 3d of last June. The interference was originally decided in favor of Sawyer and Mann, January 8, 1882, but the case was afterward reopened for the admission of new evidence. Upon a second hearing, the Examiner of Inter-

ferences again decided against Edison. The latter, however, appealed to the Board of Examiners-in-Chief, and not only set up again the claim to priority, but opposed the issuance of a patent to Sawyer and Mann on the ground that their conductor was not a paper carbon pure and simple, such as that on which he claimed a patent. On the 28th of July last the Examiners-in-Chief decided both points in favor of Edison. Commissioner Marble, however, is of opinion that the conductor of which Edison claims to have been the inventor and the Sawyer and Mann conductor are substantially the same, and that the testimony shows that Sawyer and Mann had the conductor in a rude form in March, 1878, and in a perfected form in September or October, 1878, while Edison did not have his conductor perfected until October, 1879.

Stock-Watering Condemned.

The recent decision of the Court of Appeals on the validity of the $15,000,000 stock dividend of the Western Union Company has been received by the press and public with becoming gravity. It is seen that if the law can be so interpreted in favor of stock-watering, there must be some amendment of the law, not restrictive of enterprise, but protecting the people against the enormities of its own creations.

The intensity of the public sentiment is, we think, fairly shown in the action of the orthodox, dignified, impartial Chamber of Commerce, a body that is just as willing as we are to treat the Western Union Company in a fair and generous spirit. At a meeting of the Chamber last week the opinion of the Court of Appeals in the suits of Hatch and Williams against the Western Union Company came under review and consideration, and a lively exchange of views was the result. Leading business men expressed their feelings pretty plainly, and the meeting adopted finally the subjoined preamble and resolution:

Whereas, The Chamber of Commerce having learned from the Court of Appeals that there is no existing law to prevent such flagrant stock-watering operations as those perpetrated by the telegraph companies;

Resolved, That the special Committee on Railways of this Chamber be and is requested to report, at a subsequent meeting of the Chamber, what amendments to existing laws are necessary to check this growing evil.

It seems to us that the Chamber has done no more than its duty, and we shall look for a beneficial outcome of its proceedings in the matter.

Electric Light Awards at the Cincinnati Exposition.

We stated last issue that from a telegram received from Cincinnati, it seemed as if the Thomson-Houston Electric Company had carried off all the honors in electric lighting at the Industrial Exposition at Cincinnati. The awards have since been published, and we find that the Thomson-Houston got two prizes—one a gold medal, for efficiency and regularity of action of lamp for arc lighting; and the other, $500, for highest total efficiency in the matter of arc lighting and construction, and steadiness of lamp and control of system.

The United States Electric Lighting Company was awarded a gold medal for the best electric engine for motive power of not less than one horse power, and a silver medal for the best dynamo-electric machine for arc lighting; also $300 for second best system of incandescent lighting, and $300 more for second best system of arc electric lighting. The Edison Company got a gold medal for the best incandescent light and a silver medal for the best dynamo for incandescent lighting; also an award of $500 for the greatest efficiency of dynamic generators and completeness of the system of incandescent lighting. It is announced that these awards were made on the scientific basis of figures, the tests being the most thorough and scientific that have ever been made. The committee which had the matter in charge was composed of gentlemen eminent for their ability and experience in all matters pertaining to electricity. Prof. T. C. Mendenhall, of the State University, was the chairman, and his associates were Profs. H. T. Eddy and Thomas French, of the McMicken University, and Walter Laidlaw.

The awards, however, do not appear to have pleased all the exhibitors. The United States Company entered an exhaustive protest on the subject.

APPEALING ALL AROUND.—A dispatch from Washington says that Messrs. Edison, Volker and Irwin have appealed from the decision of the examiner of interferences in the celebrated telephone case which sustained certain claims of A. G. Bell. Edison, Gray and Bell have appealed against the award to McDonough of the telephonic receiver.

Annual Report of the Western Union Company.

The annual meeting of the stockholders of the Western Union Telegraph Company took place in this city on Wednesday last. There was a large and harmonious gathering. Mr. W. J. Sims, president. Col. John Hay was elected a director to represent the interests of Mr. Amasa Stone, in place of Mr. E. D. Worcester. Mr. Frank Work was elected in place of Mr. Simmons. The pith of he report is contained in the statement that the business of the year exhibits an increase of about 10 per cent. in miles of line, 15½ per cent. in miles of wire, 14 per cent. in earnings, 18 per cent. in expenditures and 8 per cent. in profits. The large increase in expenditures was occasioned by the payment of rentals for American cables, Cuban cables, and gold and stock wires. Such rentals were charged in current expenditures, where last year they were paid for only a small portion of the year. Net earnings for the year were over 9 per cent. on the stock. The annual report of President Green for the year ending June 30, 1883, stated that the capital stock of the Western Union Company was $80,000,000, of which $20,172.50 belonged to and was in the treasury of the company. The statement of the business of the past year showed the revenues to be $19,459,902.98, the expenses $11,794,553.40, and the profits $7,660,349.58. About $467,000 was paid for interest and sinking fund on bonded debt, and $5,199,000 in dividends to stockholders, leaving $1,994,000 of excess above dividends and fixed charges to be added to $1,664,240, the surplus on July 1, 1882.

Dr. Green reported that the company held "large and valuable assets which were not purchased and paid for at a fixed price, but which were taken over under contracts with the several companies absorbed by lease or amalgamation." Those assets embrace shares in local telegraph companies, the Gold & Stock Telegraph Company, and several telephone companies, in all of the value of $10,023,-054. The Western Union Company now has 144,294 miles of poles and cables, 432,726 miles of wire, and 12,917 offices. During the past year 40,581,177 messages were sent. Dr. Green called especial attention to the statement that since July, 1866, the company's lines have been increased four-fold. It has now nearly six times as many wire facilities as then and nearly six times as many offices, and handles seven times as many messages, earning three times as much gross revenue, and making three-fold as much net profit in one year. The annual report closes as follows:

"The vexatious litigation to which the company has been subjected during the last three years is substantially and satisfactorily terminated by the late unanimous decision of the Court of Appeals, sustaining the legality and good faith of the contracts and of the stock dividend in 1881, and of the acts of the Directors in respect thereto. It only remains to be seen how far the authors of these malicious proceedings can be made answerable to the company for loss and damages it has thereby sustained."

The attorneys of the company have under advisemen the question of prosecuting Messrs. William S. Williams and Rufus Hatch, and perhaps other persons who have been authors of "malicious proceedings" against the company. There is no allusion in the report to the telegraphers' strike or the serious disturbance to the company's business caused thereby. The increase of $1,798,457.58 in the gross expenditures is attributed to rentals paid for the American cables, the Cuba cables, and the Gold and Stock Telegraph Company. Of the 800,000 shares of the stock of the company 624,170 were voted and there was but one ticket in the field. The small holdings of Messrs. Williams and Hatch were not represented at the meeting. It is expected that the new Board of Directors will meet to-day and re-elect all of the present executive officers.

New York Electrical Society.

The meetings of the New York Electrical Society were resumed Friday evening, Oct. 5, after an adjournment through the summer months.

President Small made a few appropriate remarks on the death of Professor Varley, the eminent English electrician, and appointed a committee to draft suitable resolutions thereon.

The subject of the evening's lecture was "The Use of the Electric Light in Artistic Photography, Illustrated by Diagrams and Specimens of the Results," by Prof. P. H. Van der Weyde.

After a few preliminary remarks, the Professor began his lecture by explaining, with the aid of diagrams, how the rays from the electric light were diffused in every direction, decreasing in intensity with the square of the distance. The only difference between the light of the sun and the electric light, he said, was in the degree of indensity. The electric light, as it is seen in our streets, is too weak for photographic purposes. Could all of its rays be concentrated upon the sitter or object to be photographed, then we would approach nearer the character of sunlight. This has been accomplished by means of parabolic reflectors and Fresnel lenses. The reflector, with the light at its axis, transmits the rays in a straight line and they are passed through Fresnel lenses, which concentrate the rays upon the sitter. The results by this system have been entirely successful.

The speaker then passed around among the members several photographs of prominent persons in English society, taken by his son in London by means of the above-described method. Several gentlemen in the audience competent to judge of their merits pronounced the pictures as evidencing a high degree of artistic finish and equalling, at least, the best production of the ordinary method of photography. This new method of photography, which is the invention of the Professor's son, is particularly suited to London, where sunlight is almost incessantly obscured by reason of the smoke-laden atmosphere, and where photographers count only on two or three favorable days on an average out of a week.

An establishment in this city has recently adapted the electric light to photographic purposes in a manner similar to the one above described, and with excellent results. So now it has come to pass that we have a good substitute for sunlight, and can be photographed at any time, day or night, rain or shine.

The professor made a few supplemental remarks concerning the cheap production of electricity at the present time compared with its cost when batteries were used for that purpose. One pound of coal produced as much electrical energy as five pounds of zinc, and since zinc is much more expensive than coal, an approximate idea of the reative cost of producing electrical energy by the two methods may be formed. In conclusion, the speaker predicted that the turbine wheel would be the most satisfactory means of driving dynamo-machines where water power could be obtained. A unanimous vote of thanks was then tendered the professor for his instructive and interesting lecture, after which the meeting adjourned.

The next regular meeting will be held Friday evening, Oct. 19, at eight o'clock. The society is in a prosperous condition generally. No fewer than eleven names were proposed at last meeting. The circulating library is in full operation and members are availing themselves of its advantages.

Telephone Fire-Alarms.

With telephones multiplying on every hand, so that these instruments are no longer a novelty, even in the smallest and most obscure towns, there has, says the Boston *Manufacturers' Gazette*, recently arisen a new method of utilizing them, which promises much of benefit and security to the possessor. We refer to the experiment already successfully performed by which use is made of the telephone exchange as a headquarters for sounding an alarm of fire when notified by a person connected with it. Messrs. J. H. Bunnell & Co., electricians of New York, have recently placed an apparatus of this kind made for them by Mr. George M. Stevens, of 90 Sudbury street, this city. It is located in the city of Scranton, Pa., and consists of a steam whistle on the Oxford Coal Works connected by electricity with the headquarters of the North Pennsylvania Telephone Company, distant about a quarter of a mile, by which an alarm signal is blown whenever a fire is reported in any of the districts into which the place is divided. It is also sounded at 7 A. M., 12 M. and 6 P. M. to give city time, and it is of sufficient size to be heard a distance of five miles. By means of an arrangement of this kind any person connected with the central telephone office is able to have the fire department of the city or town in which he lives notified of the existence of a fire in his establishment or vicinity without a moment's delay, thereby securing most of the benefit of an elaborate city fire-alarm system with but a very small part of the expense. To Mr. R. O'Brien, president of the North Pennsylvania Telephone Company, is due the credit of the first practical inauguration of this plan. Its advantages, considering the moderate expense necessary to introduce it, will at once be apparent to any one.

Answers Most as Quick as the Telephone.

Something stayed his feet; there was a fire in the grate within—for the night was chill—and it lit up the little parlor and brought out in startling effects the pictures on the wall. There by the soft glow of the firelight, knelt his little child at her mother's feet, its small hands clasped in prayer, its fair head bowed, and as its rosy lips uttered each word with childish distinctness the father listened, spell-bound to the spot.

"Now I lay me down to sleep,
I pray thee, Lord, my soul to keep;
If I should die before I wake,
I pray thee, Lord, my soul to take."

Sweet innocence. The man himself, who stood there with bearded lips shut tightly together, had said that prayer once at his mother's knee. Where was that mother now? The sunset gates had long ago unbarred to let her pass through. But the child had not finished; he heard her "God bless mamma, papa and my ownself,"—then there was a pause, and she lifted troubled blue eyes to her mother's face.

"God bless papa," prompted the mother, softly.

"God bless papa," lisped the little one.

"And—please send him home sober." He could not hear the mother as she said this, but the child followed in a clear inspired tone:

"God—bless papa—and please—send him—home—sober. Amen." Mother and child sprang to their feet in alarm when the door opened so suddenly, but they were not afraid when they saw who it was, returned so soon; but that night, when little Mamie was being tucked up in bed after such a romp with papa, she said, in the sleepiest and most contented of voices:

"Mamma, God answers most as quick as the telephone, doesn't he?"—*Detroit Post and Tribune.*

The Analysis of Ohm's Law.—V.*

BY JOHN T. SPRAGUE.

(*Conclusion.*)

48. One remarkable consequence of the ideas of electrical action worked out in these papers is that we can entirely eliminate the conceptions of electromotive force and of resistance, replacing them in calculation by "energy at disposal" and "facility for its transformation;" we can then arrive at the results of Ohm's formulæ by a calculation based upon unit values for these two elements.

49. For the convenience of comparing processes of thought, let us make the ampère current the starting point, the term in which we desire to express results.

(*a*) Let C be the current per second of which the ampère is the unit, represented by .00001022 gramme of hydrogen, or the equivalent of any other substance.

(*b*) Let J be the unit quantity of energy, corresponding to that of 1 ampère current during 1 second, under such conditions as we constitute the unit of "facility of transformation of energy;" actually we make $J =$ the joulad = calory .24, or more exactly log. — 1.3767503.

(*c*) Let A represent, as in section 22, the unit conductor just referred to, which permits J to be transformed from potential to kinetic energy while generating 1 ampère current: this property is, of course, dependent upon some specific constitution of the matter in which the transformation is effected, with which we have not now to concern ourselves.

(*d*) A and J are, therefore, so connected with C that any two of necessity define the third; and C and J being defined, A may be fixed by arranging a circuit in which J produces C, and this may be defined as the unit conductor. As this converts the whole of J into heat, or kinetic energy, a similar conversion will occur in a succession of such circuits through which C passes, and each must require J of energy to be supplied to it; failing this, a smaller quantity of energy will be distributed over each unit portion, and a smaller current will traverse the series.

(*e*) The value A will increase in the ratio of the number of such unit conductors equally open to the energy; that is, parallel circuits, and diminish in the ratio of the number added to the circuit; that is, in series. Or, if we regard the consumption of energy as a resistance, the *true resistance* of Section 6, then A will be *inversely* as the number of units of energy necessary to maintain unit C.

(*f*) It is obvious that we have here values corresponding to those of the volt and ohm, and of necessity so, because we have started from the ampère with the intention of making the two sets of ideas run parallel with each other, so as to illustrate the natural truths embodied in them, and evidently the actual values must be the same, whatever theoretical views we may connect to them.

(*g*) Let P be the potential energy of the gramme equivalent (expressed, as it commonly is, in calories) of any chemical reaction generating electric current, multiplied by the ampère equivalent of the substance. For example, we have, as in Section 37,

Calories per equivalent, hydrogen.....	34462	.4.5373405
Ampère equivalent "	.00001022	—5.0095453
$P =$ potential energy of reaction.....		—1.5468858

(*h*) This gives us the potential energy which we have available for charging upon the molecular chain in which it is to be rendered kinetic. This value, if divided by J, gives us the expression of E.M.F. in volts, as in Sections 37 and 39. J is, in fact, a unit expression or value of P, which needs to be reduced to this unit in order to give results in ampères of current; but J is not a volt of E.M.F. when so employed, but a form of the "equivolt," Section 40, reduced to the ampère equivalent, instead of the gramme equivalent of Section 39, or the grain equivalent of Section 40; that is, it expresses energy itself, not the E. M. F. to which the energy is equivalent when the existence of E. M. F. is assumed.

(*i*) Now, $J \times A = C$. That is to say, potential energy $\times$ by a capacity for transformation = the rate of conversion in the molecular chain in which it occurs, such conversion being effected by a molecular change or rotation, which we can call a quantity and measure as current.

This mode of considering the subject is exactly parallel with that of Section 22, where $E \times A = C$ in accordance with the usual system of E.M.F. and conduction.

50. Of course this system is not proposed as having any importance as to practical use, but it shows that the received formulæ, however useful, are purely artificial; it shows that the conceptions of electromotive force and resistance are mere expressions, not for facts or actual existences, but for *conditions;* and altogether disposes of the fictitious "contact *force*" by showing that pure energy accounts for all the phenomena which this force was invented to explain.

51. From all these considerations we learn that *electricity is a process of degredation of energy.* It is always an accompaniment or consequence of potential energy becoming kinetic, of latent force or energy becoming free, and usually taking the form of heat. Even where the object of the processes is the storing kinetic energy, as for instance in electrolysis, or charging secondary batteries, yet on the whole, less energy remains in the kinetic state as a result than was so existent before the action. No electric action ever occurs without free heat appearing somewhere as its necessary result; this free heat, which is dissipated, or work equivalent to such free heat, is the measure of the force or agency which develops electric action.

52. Electric generation is always consequent upon either,

1. The mutual action of two classes of molecules which have either,

(*a*) A different capacity or conductivity for heat, as in frictional and thermo-electricity.

(*b*) A tendency to chemical interchange, accompanied with a lowering of the total intrinsic energies.

52. The passing of conducting bodies, in which current can be produced, across a field of force (which involves a definite molecular arrangement of the substances in which it exists) in which the molecules are compelled to undergo a rotation during the transit in order to adapt themselves to the polar construction of each part of the field which they successively occupy. This is the origin of magneto-electricity and the electric phenomena of crystals.

53. In *all* cases energy is charged upon and transmitted along definite molecular chains to some point at which it becomes free. It is this energy, derived from chemical action, combustion of fuel, falling water or wind, which sets up the electric action, and the nature of that action depends upon the quantity of energy passing from the potential to the kinetic state, and the character of the molecular changes in which the transformation is effected in such manner that

Electric quantity measures the number of molecular impulses produced in the conducting chain.

Electromotive force, or potential, measures the stress in the individual chain, and under which these impulses are produced.

54. We see thus the nature of the resemblances and the differences between heat and electricity. Both are molecular motions distributing energy.

Heat is a general distribution, motion transmitted to all surrounding molecules.

Electricity is a specific motion, limited to and transmitted along definite chains of molecules, forming closed circuits and a polar system.

54. The cause which sets up the conditions may be located at one point, or distributed over various parts of the chain, in which latter case the stress on the chain is equal to the sum of the energies, but the "quantity" remains that of the single chain. Therefore the same "quantity of energy" will develop different so-called "quantities of electricity," according to the nature of the molecular chain to which it is applied, but the time occupied in the development will also vary with the conditions, and the variations in these relations are identical in nature and in proportions with those which occur in the ordinary mechanical applications of energy to doing work.

55. In concluding these papers, in which I have endeavored to give a distinct meaning to various terms which are but vaguely apprehended by many who use them, I may express the hope that they may satisfy many who are discontented with the commonly taught doctrines of electricity, and show them that these doctrines do really contain within themselves much more than their teachers usually explain. Thus, Mr. Theophilus Varley, who wrote an interesting letter on "Electricity, What is It?" may find that many of his ideas are developed both in these papers and in my "Electricity," while the variety of units to which he objects arises from giving a different name to different aspects of the same conception. It is more convenient to separate the ideas of the coulomb, ampère, and farad than to attach explanatory words to one unit, that is, it is more convenient to have the unit of current the ampère, than to speak of the coulomb per second, and the same applies to the joulad and the watt as expressions for the energy or power corresponding to an ampere linked to a volt.

* London *Electrician.*

Notes on the Vienna Electrical Exhibition.

To our already copious and interesting notes on the Vienna Exhibition we add the following:

Highly interesting, though not new, are also the various Mangin projectors exhibited by Messrs. Sautter and Lemonnier of Paris. They are constructed both for use in the field and also for men-of-war. For use in the field, a boiler, steam-engine, and Gramme dynamo, with a Mangin projector, are placed on a strong carriage drawn by two, four or six horses, according to the size of the apparatus. The reflector itself is a spherical metallic mirror, which renders the rays parallel, and a hand-worked arc lamp of the Dubocq type supplies the necessary light. For men-of-war the projector is placed on a firm support, and the Gramme machine is driven by a special Brotherhood engine. One of the latter projectors has an ordinary mirror attached in front, by means of which signals can be sent, and also one mirror on each side, which enables the operator to bring the whole of the horizon within the field of vision.

One of the most interesting exhibits at the Vienna Electrical Exhibition is Gentilli's glossograph, a little instrument by which speech is automatically reproduced as soon as it is uttered. A small apparatus is placed in the mouth of the speaker—in contact with the roof of his mouth, his tongue and lips—and on being connected with an electro-magnetic registering apparatus the sounds are committed to paper. It is constructed in such a manner as not to cause any inconvenience to the speaker; neither is it necessary that the voice should be raised, as it reproduces a whisper as exactly as a shout; the only condition is a correct and distinct articulation. According to the inventor's calculation, it will be possible to write four or five times as fast by means of the glossograph as has hitherto been possible, even by the quickest writer. At first sight it appears as if this invention were but an improvement upon Edison's phonograph; it is, however, of a much older date. It rests, unlike the former, on an acoustic principle, and does not reproduce the sounds in a microscopical form. The chief obstacle to the introduction of the glossograph, says the *Pall Mall Gazette*, will be the difficulty in deciphering the characters, but it is not impossible that with the help of a second automatic apparatus the characters produced by the glossograph may be translated into our common type-writing. The orthography would doubtless appear strange, but in these days of phonetic spelling this might not long be a hindrance.

The Bernstein Electric Light Manufacturing Company of Boston is evidently making a success of its exhibit at the Vienna Electrical Exhibition. A correspondent of the London *Times* speaks in the highest terms of the Bernstein lamps, which in his belief are "destined to create a revolution in electric lighting," on account of their ability to illumine large areas.

In describing the lamps exhibited the *Times* correspondent further says:

"The ordinary incandescent lamp has a very fine carbon filament with a very small illuminating surface. The Bernstein lamp employs a hollow, semi-circular carbon cylinder, which is quite elastic, and has a comparatively large illuminating surface. The lamp resembles an ordinary incandescent lamp, with a thicker carbon filament, but in its effects it differs materially from the ordinary type. With an electromotive force of twenty-three volts and a current of seven ampères, it has an illuminating power of sixty-five candles; it stands midway between an incandescent and an arc lamp. As regards its durability it has the great advantage of requiring but a low electromotive force—the higher the electromotive force the more rapid the disintegration of the carbon filament and the shorter the durability of the lamp. The manufacturing process of the filament is not published yet, because the patents have not been completed for the different countries. The low electromotive force also permits the use of a very large number of lamps in series, and, therefore, the illumination of long distances by means of a very thin wire."

The Light at Brockton, Mass.

The fact that the Edison Electric Illuminating Company of Brockton has started its plant in that lively burgh has already been stated in our columns, together with the information that the work enjoyed the personal supervision of Mr. Edison. Considerable interest naturally attaches to this installation, from the fact that it is the first attempt in that section to introduce electric lighting by incandescence, into dwellings, stores and other buildings, from a central lighting station, on the same principle as gas lighting had been done, mains being laid through the streets, the buildings wired, meters put in and bills for light being periodically rendered according to the meter registers. A company with the same ends in view was organized in Boston some months ago, but for various good reasons its practical opening for business has been delayed and Brockton has taken the lead. Similar companies in Lawrence and Fall River are nearly ready to begin operations. Of isolated lighting plants, in which the power is furnished within the building lighted, there are several in successful operation in Boston and elsewhere in Massachusetts, but Brockton is the first place in which a general company to sell the incandescent light to all available persons has been put in operation. The central lighting station at Brockton is a one-story brick building, 50 by 65 feet in area, one-half of which is devoted to the boiler-room, and the other to the engine and dynamo room, office and laboratory. The size of the building is sufficiently large to allow of a doubling of the present plant, and the lot on which it stands is only about half covered, so that, if the increase of business demands, the building can be extended on both sides and the present plant quadrupled. The present battery of boilers consists of two Babcock & Wilcox boilers of 75 horse-power each, and the adjoining room contains two Armington & Sims engines, one of 150 horse-power and the other of 60, three Edison "H" dynamos with a capacity of 1,100 lights each, and all the necessary switches, regulators, test lamps and other paraphernalia of a complete central lighting station. The office, a small, neatly appointed room and the laboratory, in which are kept the meters—each of which is a most ingenious and elaborate piece of mechanism—and other needed supplies fill the remainder of the building. The main conductors are laid underground, Edison's recently devised "three-wire system," which brings about a saving of 62½ per cent. in the weight of the copper required for the conductors, being used. The present capacity of the station is 3,300 standard lamps, but at present buildings

have been wired for 258 lamps only, and the company starts off with that number. In the dynamo-room, Oct. 4, Thomas A. Edison. the inventor, was at work, busy as a bee, with a corps of assistants, putting the finishing touches to the installation, and as it grew dark, the big Armington & Sims engine was started up, two of the large dynamos began to buzz, and the lights in the station and in the private buildings supplied therefrom gleamed out brightly. The Brockton company is started on the principle of doing a commercial business of furnishing light, and as several new buildings are being wired and there are many others ready to adopt the new light, it is expected that very soon a large lighting business will be done here. Charles G. White is president; W. L. Garrison, treasurer; W. J. Jenks, manager, and Messrs. George P. Denny, of Denny, Rice & Co., James P. Tolman, Frank J. Coburn, C. B. Prescott and Charles G. White, directors.

Some Unobserved Phases of Electrical Progress.

The attention of the general public has been drawn of late years to the subject of electricity through the attraction of the dazzling electric light. Of the progress made during this period in other and perhaps more important applications of the science to the useful arts but little is known, since such matters rarely find their way into the popular literature of the day.

We refer here principally to the advances made in the application of electricity to chemistry, metallurgy and galvano-plating, which, though less attractive than the application of the science to illumination, are collectively of much more industrial importance. In the field of electro-chemistry, for example, eminent chemists and electricians have busied themselves in testing the theoretical views and opinions of their predecessors, have demonstrated the correctness of some of them; have modified others; and in some cases have advanced new theories.

The method of analysis by electrolysis, which until lately was but rarely enjoyed in the laboratory, has, by reason of the discovery and systematic development of a number of new and reliable methods of determination and separation, not only become a valuable aid to the chemist in analytical work, but has become of the highest importance to the metallurgist.

The analysis of certain minerals and metallurgical products, which, until the origination and improvement of the electrolytic methods of separation, had been a procedure of great difficulty, is now rapidly accomplished, with rapidity and certainty, with their aid.

In metallurgy, the production on the large scale of metals, in a state of extraordinary purity with the aid of the electrical current, is now an accomplished fact, and the method is now firmly established as a technical and commercial success. Its eminent practical value is shown by the introduction of the electrolytic process in some of the most extensive metallurgical establishments.

In close connection with the application of the electrical current to metallurgical work, the utilization of the heat of the voltaic arc for the smelting and working of metals deserves to be mentioned. In this direction, the electrical smelting furnace of Siemens—a device that has attracted profound attention in scientific circles—suggests the possibility that within a few years the metal worker may have placed at his disposal a source of intense heat, which may prove of enormous value.

Again, the separation of metals from particles of mingled iron, and the purification and concentration of ores of iron by electric means, has come to be quite a useful and important operation.

Galvanoplasty, or the art of producing metallic deposits upon objects of metal, etc., for artistic or useful purposes, has of late years been enriched by a long series of new and improved methods, which have had the result of elevating its practice from the stage of empiricism to the rank of a recognized branch of applied science, based upon accurate scientific methods. The rôle which the dynamo-electric machine—by which mechanical energy is directly converted into electrical current—has played, in developing and extending this important branch of electrical technology, we have elsewhere pointed out. It has contributed more than any other cause to the immense extension of the art of electro-plating in all its branches; it has called nickel plating into existence; and by greatly cheapening the cost of a multitude of artistic and useful objects, has placed within the reach of those of slender means, even, the possession of beautiful and serviceable wares of great variety which are not distinguishable in elegance of appearance from the most costly articles which are of necessity the exclusive property of the rich.

In addition to these notable evidences of progress we might enumerate a large number of new and interesting inventions and discoveries, extending the application of electricity to the most diverse branches of industry, and these are being extended day by day. It is true that many of these will probably not stand these crucial test of practical application, but this fact does not detract from the strength of the assertion that the most valuable applications of electricity to the industries are those which are only brought indirectly to the knowledge of the general public.—*Manufacturer and Builder.*

The Torpedo Fish.

A naturalist recently made some interesting experiments, recorded in the *Sun*, one of which was the application of the telephone to a torpedo to see if the shock gave an audible sound. Such proved to be the case—a short, low croak accompanying moderate excitement, the discharge lasting about one-fifteenth of a second. When the fish was greatly excited the croak became a groan, sounding, it was said, like the tonality of *mi*, and occupying four or five seconds. When the attention of scientific men was first called to the torpedo, Dr. Walsh, F. R. S., amused himself and scientific London with one of these fishes, after a series of experiments at the Isle of Rè. The performances took the form of piscatorial séances, and it became the rage to take a fish shock. Wondrous medicinal virtue was ascribed to it, and the demand for torpedoes brought a rich harvest to the fisherman. Their use in medicine, however, was not new, as Discorides, the physician of Antony and Cleopatra, is said to have used it. Dr. Walsh's method was to place a living torpedo upon a wet towel; from a plate he suspended two pieces of brass wire by means of silken cord, which served to insulate them. Round the torpedo were eight persons standing on insulated substances. One end of the brass wire was supported by the wet towel, the other being placed in a basin full of water. The first person had a finger of one hand in this basin, and a finger of the other hand in a second basin, also full of water. The second person placed a finger of one hand in this second basin, and a finger of the other hand in a third basin. The third person did the same, and so on until a complete chain was established between the eight persons and the nine basins. Into the ninth basin the end of the second brass wire was plunged, while Dr. Walsh applied the other end to the back of the torpedo, thus establishing a complete conducting circle. At the moment when the experimenter touched the torpedo the eight actors in the experiment felt a sudden shock, similar in all respect to that communicated by the shock of a Leyden jar, only less intense. The torpedo was then placed on an insulated supporter, and communicated to twenty persons similarly placed, from forty to fifty shocks in a minute and a half. Each effort made by the animal was accompanied by a depression of the eyes, which were slightly projecting in their natural state, and seemed to be drawn within their orbits, while the other parts of the body remained immovable. If only one of the two organs were touched, in place of a strong and sudden shock, only a slight sensation was experienced—a numbness rather than a shock. The same result followed with every experiment tried. The animal was tried with a non-conducting rod, and no shock followed; glass or a rod covered with wax produced no effect; touched with a metallic wire, a violent shock followed.

Dr. Atwood, of Boston, in making experiments with a powerful fish, was several times completely floored, and when at a distance of twelve feet he struck a fish with a harpoon, the shock was so powerful that he could not release his hold.

Quite a number of electric fishes are known, of which the South American gymnotus is undoubtedly the most powerful. It is said that they are caught by driving wild mustangs into the water, the fish exhausting their powers upon them, often fatally. The torpedoes are then captured by the natives. In all, nine different species are known, three of the curious electricians belonging to the ray family. One is a sword fish, another a catfish called in the Nile country the "thunder fish," and the third is the *Tetraodon electricus* from Comoro. The latter gives a faint shock, but strong enough to form probably a protection from various animals.

Use of the Divining Rod.

A Mr. G. W. Morrison, of Romeo, Greene County, Tenn., writes to one of the daily papers with regard to the divining rod, whose virtue is derived from the electricity, he claims, with which its holder is charged. He puts his case thus: I know that science does not recognize such a thing, but were not all the sciences tested and proven by practical experiment before they were recognized by the scientific world? There is a man in this county who believes as strongly in the divining rod as the navigator does in the mariner's compass. He is not an illiterate, superstitious man, but is as well informed on all subjects as any laboring man you ever met. He does not claim that he is enabled to locate a stream of water or a vein of mineral beneath the surface of the earth by any virtue contained in the rod, nor is it by the art of hocus pocus, but it is in and through the influence of electricity, with which his system is abundantly charged.

You will say: "If this be true, why does he not go to some mining country and make himself and others rich by locating mineral veins?" He is a man that has had to labor very hard all his life. Now he is old and infirm, and unable to travel. This discovery with him dates only a few years back. His field for practice and experiment is limited, consequently he gains knowledge on the subject slowly.

I will mention a few of the things that he claims he can do with the rod: He can locate a stream of water, and, where the ground is perfectly level, measure its depth below the surface as accurately as you can measure it after the well is dug. He does not claim the depth within less than a foot, b cause the surface is so seldom perfectly level. There are hundreds of men in East Tennessee that will testify to this fact from actual experience. Some of them are as responsible men as there are in the State. He has never failed to convert any man who would go with him, no matter how skeptical, and he has certificates from a number of as intelligent men as there are in Tennessee.

Strange Freaks of Lightning.

Mr. W. A. Alden of the New York *Times* tells the following of the doings of untamed electricity:

The freaks of lightning are certainly wonderful when they are told by Western newspapers. For example, it is now asserted that in 1853 a Congregational meeting-house in Lockport was struck by lightning during divine service, and doubtless at the very time that the choir was executing an anthem in seven simultaneous keys. One of the young ladies of the choir was stunned, and on regaining consciousness was found to have lost her watch and chain. She remained ill for several months, during which she suffered from a pain in her side, but in time the pain ceased. A short time ago the young lady—who appears to have grown no older in thirty years—noticed a swelling on her arm. The swelling increased and worked downward, and it has just been discovered that the missing watch and three feet of chain were safely imbedded in the arm. The lightning obviously drove the watch and chain into the young lady's side, and for thirty years the lost articles have meandered through her system until they have finally reached the surface.

Strange as this story may seem, it can be matched by the experience of Mr. Josiah H. Stringly, who, forty years ago, was leaning on his ox-cart in front of the Baptist meeting-house of Oshkosh when the steeple was struck by lightning. Mr. Stringly was stunned, his oxen were killed, and the cart was apparently annihilated. After recovering from the effects of the lightning, Mr. Stringly became a book agent, and practiced that calling until about a week ago, when an indurated swelling on his right cheek attracted his attention. He found that it was caused by a link of an ox-chain, and on trying to pull the link out of the cheek twelve feet of heavy ox-chain and the missing ox-cart were recovered—the latter in perfect condition, with the exception of one of the tires, which was slightly corroded. This story teaches us that we should never play with lightning, but should always tell the truth.

The Lowell Syndicate and the Boston Exchange.

There have been rumors current that a closer alliance would shortly be made between the American Bell and Lowell Telephone (New England) companies, and that the Lowell syndicate would absorb Boston. This has to some extent affected the stock market. According to the latest report, as we were going to press, the negotiations for another consolidation of the New England Telephone Exchanges have been completed, and meetings of the stockholders have been called. The Boston and Northern, the Bay State, and the Suburban companies will meet at Lowell on Oct. 17, the National Bell, of Maine, at Portland on Oct. 18, and the Granite State at Manchester on Oct. 19. These five companies will be consolidated with the Boston Exchange, with a capital of between $9,000,000 and $10,000,000, paying 6 per cent. The Providence Company and the Southern New England Company do not, it is further stated, come into this consolidation. The American Bell Company will hold a majority of the stock, and Theodore Vail is named as the probable president.

THE TELEPHONE.

MADISON, IND., and Louisville, Ky., are connected by telephone.

IN MAINE.—There are now 250 telephones in the Lewiston and Auburn circuit.

A GOOD SHOWING.—The telephone business of Bradford, Pa., gives employment to thirty or more people.

PALMER WIRE CO.—The Palmer (Mass.) Wire Co. have just declared a 3 per cent. semi-annual dividend from their earnings since April 1, payable Nov. 1.

AN ACCIDENT.—Workmen erecting a telephone pole in Harrisburg, Pa., let it fall, and it crashed through the rear of Stephen Bitner's residence. Fortunately no person was hurt.

A NEW LINE FOR MAINE.—A new telephone line has been built between Bangor and Rockland, and another is contemplated between Lewiston and Augusta, via Winthrop.

HOLYOKE, MASS.—The Holyoke telephone exchange has 375 subscribers on its list, an increase of 75 during the past year. This speaks well for the manager, Mr. Perkins.

ATLANTA, GA.—The list of subscribers to the Atlanta, Ga., telephone exchange, H. H. Jackson, manager, has 283 names upon it, and probably by this time has turned the three hundred corner.

NEW BUSINESS IN TEXAS.—The Erie Telephone Company began to open extra territorial lines in Texas last August, and returns just received indicate earnings of $1,600 that month from this new class of business.

HOW THE MEXICANS LIKE IT.—Advices from Mexico re-

port about 500 telephones connected and in use in the City of Mexico, against 357 at the last report. Every month is now expected to show material increase.

Telephone Extensions in Texas.—The Southwestern Telephone Company has decided to connect Marshall with Jefferson immediately, construction to begin at both ends of the route. Lines will also radiate from Marshall to Shreveport, Longview and Dallas in the near future.

"It was the Cat."—One of the Providence, R. I., business men was aroused by telephone from his slumbers at two o'clock one morning last week by the private watchman at his office, who had ascertained that a pet cat had been imprisoned in the gentleman's roll top desk, it having been closed hastily, and pussy, fast asleep, not having been noticed. He responded.

The Louisville Girls Cheerful.—Girls in the Louisville, Ky., telephone office talk very cheerfully about their work. One not long ago married a nice young man who was charmed with her sweet voice over the wire, and another who had been married and divorced was reconciled and remarried to her husband because he happened to hear her speaking and couldn't stay mad a bit longer.

"Put on Your Overcoat."—A stuttering clerk in a down-town store tackled the telephone yesterday. He rang up "Central" and began to talk as follows: "H-h-h-hel-hel-hello, C-c-c-c-central! Ker-ker-ker-can yer-yer-you ger-ger-ger-ger-give m-m-m-m-m—" Here the voice of the Central office man interrupted the struggle with: "For heaven's sake, stop that chattering and put on your overcoat, if you're cold."—*Com. Advertiser.*"

Another Parable.—An attentive reader, referring to the parable in last issue, page 87—"Parent and Teacher"—writes: The following "parable," which is a paraphrase of that of the *Belli*gerent Berliner, and may be of interest to some of your readers: "A child born in the wilderness loses his parents at an early age, before he has quite learned to talk. When he has grown up he is stolen by a person who has been taught by his parents to talk glibly and who teaches this unfortunate one to talk as glibly as himself. Subsequently, this individual takes out an exclusive patent for teaching children to talk."

A New Company.—The McDonough Telephone Company was incorporated at Albany, N. Y., on the 6th inst. The capital is $1,000,000, with the proviso that it may be increased to $20,000,000. The principal office will be in New York. The lines are to extend from New York to San Francisco, New Orleans, Portland, Me., Boston, and other places. The incorporators are James W. McDonough, George R. Williamson and Henry C. Townsend, of New York; William J. Vanpelt, Jr., of Hoboken, and George W. Coy, of Milford. The formation of the company is due to the United States Telephone Manufacturing Company of this city. In order to do a telephone and telegraph business, it was found necessary to organize a new company. The telephones used will be of the McDonough patent.

Eastern Shore Telephone Lines, Maryland.—The Centreville (Md.) *Observer* says there is a public telephone line from Eastern to St. Michael's, and in Queen Anne's there is a public line of twenty miles length and a regularly organized stock company. This company is acting under contracts for the Bell Telephone Company of Boston, and as soon as possible will extend its wires to all the important points in the country. The same paper mentions a recent meeting of the Queen Anne's Telephone Company, at which Dr. Winchester submitted his report of the line of which he has had the erection from Queenstown to Stevensville. The temporary arrangement at the ferry by which the wire is carried across will be taken away, and a cable put there instead. A call was made for more stock. The account of the working of the line from Centreville to Queenstown was rendered, and, after paying all expenses, it was found that in three months the line was paying at the rate of thirty per cent. per annum on the capital stock. Owing to some difficulty with the Bell Telephone Company, the line to Church Hill will not be built as soon as was thought.

A Telephone Millionaire.—A correspondent of the Cleveland *Leader*, writing from Morristown, N. J., says: "Another man of note who claims Morristown for a home is Vail, the telephone general manager. He was born in the country near here, and clerked for a long time in a drug-store in Morristown. Leaving here he got into the postal service, and there made his acquaintance with Dorsey, Brady & Co. He is now worth a million, and is the nominal if not the real owner of Brady's house in Washington, for which say the legal papers he paid $125,000. It is right that Vail should make a fortune out of electricity. He has the right by inheritance. His father, Alfred Vail, was co-equal with Morse in the invention of the telegraph. Alfred Vail owned the Speedwell iron-works here, and Morse and he here got up their first telegraph instrument and did telegraphing before the line was stretched from Baltimore to Washington. Vail completed the machinery in 1837, and he furnished Morse with the finances for his experiments to perfect it. At these works of Vail were also made the first cast-iron plow of American make, and the steamship boiler which first crossed the Atlantic."

Troubles at Rio de Janeiro.—We clip the following from the Rio *News* of Sept. 5: On the 25th ult. the *juiz de direito* of the 2. *vara commercial* of this city rendered an important decision in an action brought by the telephone company against the president and directors of the Companhia Nacional de Electricidade in the matter of recently issued patents on the Bell telephone inventions. He held that as the Bell telephones have been known and used in this city since 1877 no patents can now be issued upon them and that those granted, therefore, are null and void. He alse condemned the methods employed to secure these patents as irregular and charged the president of the Companhia Nacional with acting in bad faith. He thereupon declared the patents null and condemned the defendants to pay all damages and costs. This sentence cannot be otherwise than highly satisfactory to the public at large on the grounds already taken in these columns. We have before called attention to the manifest irregularities connected with the organization of this Companhia Nacional and with the subsequent effort to seize the telephones imported by the old company. The final defeat of these schemes will certainly give general satisfaction.

A Lofty Telephone Station.—On the topmost height of Red Mountain a slight prominence, that looks no larger than a bushel basket, can be seen, which is a telephone station established by the Central Pacific Railroad Company. This is a house occupied by two watchmen, who are on the outlook for fires in the snow sheds. They can take in the whole line of snow sheds with their natural sight and by the aid of glasses. If they observe a fire in or near the sheds on any part of the line, they immediately notify the station at Cisco by their telephone line, and forthwith the information is sent by telegraph to the railroad station at Sacramento, and in a minute or two the order is sent up the line to Blue Cañon, and the Summit, where the trains are constantly on duty, to proceed to the point where the fire is prevailing. The fire train consists of a locomotive, with two tank cars filled with water, which is thrown with hose by a steam force pump. When the fire trains are sent out they have the road, all other trains near the point of danger being stopped. The services of these fire trains are frequently called upon, but they are so prompt in action that they generally subdue the fires before much damage is done.

The Hartford, Conn., Circuit.—The new telephone system is creating considerable comment among shopkeepers, says a correspondent of the Springfield *Republican*. At present the towns of Windsor Locks, Suffield, Thompsonville and Warehouse Point belong to the Hartford Circuit, and a man who pays $50 a year for the use of his telephone can talk with people in Hartford without extra charge. It is now proposed, and the plan is being carried out, to make a separate circuit of these towns, together with Hazardville and Broad Brook, having connection with Hartford only through a central office located in F. L. Mather's Windsor Locks store. Under this arrangement a charge of 10 cents is made for every time the Hartford office is called. It so happens that these towns have but little communication with each other, but most of their telephone business is with Hartford or Springfield. Windsor Locks and Warehouse Point people are making the utmost exertion to secure fair play, even threatening to dispense with every telephone in their borders. A later communication adds: The central office of the new telephone system is to be in F. L. Mather's store, and will be ready for operation by next week. The manufacturers say that they will have nothing to do with the new arrangement, and that, though a wire is being run to Suffield, the business men of that place, also, will let the system severely alone. The manufacturers of Windsor Locks will run a private wire about their town.

Completion of a New Line in Ohio.—Telephonic connection has been completed between Youngstown, O., and Cleveland via Ravenna and Akron. The line as constructed between the two cities is about seventy-five miles long. On account of alleged frequent bad service of the telegraph companies the completion of the telephone line is a source of congratulation among business men. The rates will probably be twenty-five cents for the use of the line five minutes.

A Parting Gift.—Before leaving Cincinnati Mr. J. E. Hockett, late private secretary of Superintendent Miller, of the Western Union Telegraph Company, whose appointment as superintendent of the Central Union Telephone Company at Indianapolis we noticed in last issue, was presented by his associates with a handsome gold chain and locket and a box of cigars. It was a spontaneous and hearty gift to one of the most popular young men in the telegraphic service, as well as elsewhere. The locket bore the inscription, "J. E. Hockett, from his co-workers of the W. U. T. Co., September 29, 1883, Cincinnati, O." The following letter accompanied the gift:

Cincinnati, O., Sept. 29, 1883.

Dear Ned: These cigars, the chain and locket, are all "loaded" with the good will and best wishes of a few of your numerous friends, who desired in some way to express to you their kindly feelings, and their appreciation of your many kindly acts and steadfast friendship. This remembrance differs from most affairs of the kind, inasmuch as it most nearly resembles a spontaneous offering, the only difficulty being to keep the affair within bounds, and, in fact, many who would have liked to be remembered have been neglected. We wish you success in your new home, and if you find as many friends there as you leave here, we congratulate both them and yourself.

THE ELECTRIC LIGHT.

Adams, Mass.—Electric lights are being put in the gingham mill at the above place.

Ohio.—Arrangements are being perfected to organize an electric light company in Youngstown.

Boston Common.—Electric lights similar to those on the Public Garden are soon to be put on the Common.

A Name for It.—New York suggests calling the electric light the "lec light." The "tric light" would be more appropriate for some companies.—*Boston Com. Bulletin.*

"On With the New."—The public nowadays have almost as much contempt for gas as they had for oil lamps. Old friends fade before brilliant newcomers.—*Evening Telegram.*

Turning Night Into Day.—A large dock is in construction at Hull, England. There are 2,800 men employed, and the work is carried on at night by means of the electric light.

Another Indiana Town Falls into Line.—A stock company has been organized at Elkhart, Ind., by which the city will be lighted in thirty days by the Brush system of electric light.

Not a Village.—The Fargo (Dakota) *Argus* protests that that place is an electric-lighted city of 11,000 people, with twenty-eight hotels, and that it must not flippantly be called a village.

Fall River, Mass.—The Fall River Edison electric light station has ordered two 150 horse-power, and one 60 horse-power Armington and Sims engines, and that at Lawrence one of each size.

A Plant on Wheels.—A traveling electric light plant is a new feature on the Cumberland Valley in Pennsylvania. It is employed for lighting up wrecks on the road, or for any emergency that requires night work.

Bethlehem, Pa.—A building 24x37 has been staked off for the Bethlehem Electric Light Company. It will be of brick, and will contain all the necessary machinery. The stock has all been subscribed for, and 25 lights have been engaged.

The Connecticut Co.—The stockholders of the Connecticut Electric Light Company, which recently suspended operations, have voted to sell the New Haven plant to Herrick P. Frost, president of the Southern New England Telephone Company. The company had invested $53,000.

The Light in California.—The engineer of the San Jose Brush Electric Light writes, under date of Oct. 2: "During the triennial conclave and the county fair, our system of street lighting in this city was greatly admired by strangers, and with the residents it is giving general satisfaction."

Illinois.—A license was issued on the 1st inst. to the Globe Electric Light and Power Co., Chicago, capital $600,000; incorporators, J. F. Rhodes, James L. Gage and Francis E. Morse. A certificate of change of capital stock from $10,000 to $20,000 was filed by the Forest City Electric Light and Power Co., of Rockford.

A Little Surprise.—At a banquet given in Paris by the Metropolitan Electric Lighting Company, a surprise awaited the guests as they left the table. A gigantic tramway carriage, moved by electricity, entered the courtyard of the hotel and cleverly manœuvred in the narrow space, the great crowd wondering that there was no accident.

Not a Light Job.—To light London, England, by means of electricity is a pretty heavy contract, as the following figures will demonstrate: There are 4,000 miles of streets, at present using 630,000 gas-lamps, and consuming every 24 hours 2,270,000 cubic feet of gas. Some of our enterprising electrical-lighting companies ought to "figure on the job."

The Boulton Carbon Co.—Papers of incorporation have been issued to the Boulton Carbon Co., of Cleveland, capital stock $250,000. The incorporators are Wills U. Masters, William Henry Boulton, Edward C. Pope, Charles Heart and Charles A. Warren. This corporation was organized for the purpose of manufacturing and dealing in all kinds of electrical goods and other wire productions.—*Cleveland Trade Review.*

Electric Light Engines.—The Ball Engine Company, of Erie, has recently sold, to each of the following companies, one of its engines of 45 horse-power: The Brush Electric Light and Power Co., of Cleveland; the Brush Electric Light Co., of Buffalo, and the Brush Electric Light Co., of Emporium, Pa. A Ball engine, as we mentioned in last issue, is now furnishing the power for the Fuller electric light in the Mechanics' and Manufacturers' Institute Fair in Boston.

Doings in the Dominion.—Some changes have been made, says the Toronto *Monetary Times*, in the management of the Edison Electric Light Company now the home office in New York is conducting the business. The dynamos, lamps, etc., are all made in the city of Hamilton. The Canada Cotton Company has had 500 of these lamps in use nearly six months and has ordered as many more.

The Valleyfield Cotton Co. too, have about 800 of these lights.

LIGHTING UP THE RHINE.—The persons who are interested in helping forward the attractions of Schaffhausen and Neuhausen have illuminated the falls of the Rhine every night recently. The falls and Schloss Laufen (a house on the opposite bank and on top of the wooded cliff) appear alternately in Bengal colors, the effect of which is said to be very beautiful. The Schweizerhof, at the falls, is one of the best hotels in Europe, and there is a splendid view from its terraces and shrubberies.

ELECTRICITY ON THE STAGE.—A burlesque of Shakespeare's "Tempest," by Mr. Burnand, entitled "Ariel," was produced in London on the 8th inst., and the electric light appears to have played a leading rôle. Tremendous applause shook the Gaiety Theatre as Miss Nellie Farren, in the part of *Ariel*, came on with three electric stars in her hair, and again when she floated in the air amid a halo of electricity that shed magic hues upon her golden wings. Other uses of the light were made to enhance the brilliancy of the spectacle.

COLUMBUS, O.—The stock holders of the Electric Light and Power Company last week elected the following directors: William Moneypenny, E. T. Mithoff, A. G. Patton, W. B. Hayden, A. D. Rodgers, S. A. Barton and T. P. Gorgon. The board elected the following officers: President, E. T. Mithoff; Vice-President, William Moneypenny; Secretary and Treasurer, J. G. McGuire. The company will immediately place one hundred lights in position, after which it will proceed to permanently locate its works to furnish private parties with the light.

AT WILLIMANTIC, CONN.—The Brush-Swan system of electric lighting by means of storage batteries and incandescent lamps was shown at Willimantic Wednesday night, the 3d inst., to a large crowd of factory men, government agents and reporters. The Willimantic Linen Company has adopted this system, and has had six batteries and 360 lights running for six weeks without a break or failure. The mill men expressed themselves highly satisfied. The exhibition closed with races on the Willimantic Fair Association's track, which was brilliantly illuminated with 34 Brush electric lights.

THE LIGHTING OF LOWELL.—The Lowell *Courier*, of Oct. 9, says: Last night the current was turned on the city circuit, and the 50 lights which the lighting committee had contracted for were burned for the first time. The effect was very brilliant and satisfactory, and for a first night everything worked well. Some of the lights went out occasionally, but this defect will be corrected. President Goff and other officials drove about the city and inspected the lights. Some of them are fitted with ground and some with clear globes, but it is probable that the latter will be adopted for all of them. After this week the light will burn all night. At present they run until midnight.

UNDERGROUND WIRES FOR ARC LIGHTING.—The underground wire system for electric arc lighting does not seem as yet to have been perfected so as to make it practicable or trustworthy. The New England Weston Electric Light Company of this city has been experimenting for some months with an underground cable to run its lights in Park Square and in front of the Providence depot, but there have been several periods when it has been necessary to run the lights by overhead wires. On Monday the cable was dug up, and it was found that the heavy copper conductor had been burned off and the insulating covering destroyed for several inches by the intensity of the current. A lead-covered cable is now being laid in a box or conduit of wood, and it is hoped that this may work satisfactorily.—*Boston Advertiser.*

RADIANT RIO.—Since the evening of the 23d ult., says the Rio de Janeiro *News* of September 5, a successful experiment in electric illumination has been in operation at the Largo do Machado under the direction of the representatives of the United States Electric Lighting Company and Mr. Charles B. Raub, electrician. Ten Weston lights of 2,000 candle-power each have been employed, and with results never before witnessed in this city. The dynamo is stationed in the Botanical Garden Company's building, where it has been visited by the Emperor and a large number of people. Thus far the lights have burned steadily and without the least interruption, thus demonstrating their great value as a means of public illumination. We understand that a company is being organized for the introduction of this light into Brazil.

THE ELECTRIC ARC IN THE MICROSCOPE.—At a recent meeting of the Cleveland Microscopical Society last week, Dr. Moore, professor of microscopy in the Cleveland Homœopathic College, exhibited a miniature arc electric light, which, when seen under the microscope, was magnified fifty diameters. The professor used for his carbons two of Wallace's bamboo filaments, which had been carbonized by being baked in coal tar. The electric current, which was produced by a bicromate of potash cell, passed through an ordinary induction coil, and exhibited itself in the form of an electric arc in the focus of the microscope. According to the *Leader*, when viewed through the microscope, the exhibition looked like a perfect representation of the Brush arc-light as seen through a piece of smoked glass.

WILL THERE BE A CONSOLIDATION?—The Boston *Globe*, referring to the awards to electric light systems at Cincinnati, says: It will be seen that the Thomson-Houston and the Edison systems stand at the head of the lists, each representing the best light in the different systems, viz.: the arc and the incandescent, and neither of which, by the way, interferes with the other. Inasmuch as Mr. Goff has developed so much strength in the field of electric arc lighting, so far having outstripped all his competitors, it is more than likely that he will join hands with the Edison people, which would, with the combined strength of the two companies, give them the control of the field of electric lighting. In fact, if this combination is made, the stock in either company would be more than double in value.

NEW BEDFORD, MASS.—Speaking of the electric light in New Bedford the *Standard* says: The building on the north side of School street, just west of Front, to contain the engines of the New Bedford Electric Lighting Company and other necessary apparatus, is substantially completed. One engine of 50 horse-power, built by Armington & Sims of Providence, is already put in, and a foundation is laid for another of equal power when it shall be found necessary. The engine now in position will furnish power sufficient to generate electricity for fifty lights. In the rear of the main building a boiler house will be erected, and a boiler of 100 horse-power, built by Thomas Cunningham of the Charlestown district, Boston, has been put in position, while a chimney forty-five feet high is building. The work of erecting poles and stretching the wire will begin in a few days.

MERCHANTS' CO., BOSTON.—At a meeting of the Board of Directors of this company, held on Wednesday, Oct. 3, 1883, it was resolved that in view of the large increase in the company's business, which practically assures larger earnings upon its capital stock than anticipated when the company began business, this Board reserves the right either to withdraw the stock from the market altogether, or to advance its price, after giving due notice thereof. It was then voted to advance the price of the treasury stock from $10 to $12.50 per share after Saturday, Oct. 13, 1883. Notice has been issued in accordance with the foregoing. A dispatch from Boston of the 5th says that this vote has greatly increased the demand for the stock as an investment, and that it is probable that the entire amount offered will be absorbed before the day set for closing the subscription.

THE TELEGRAPH IN PERU.—Mr. V. P. Mac Cord, chief of traffic and telegraphy of the railroad lines in Peru, is in America on a visit. Mr. Mac Cord was an operator in the West and in the oil regions twenty years ago. The lines over which he has supervision run from Mollendo, on the coast, to Arequipa and Puno, on Lake Titicaca, which is the highest navigable water in the world. The chief lineman is Mr. Wm. Cannon of New York. All the operators, about forty in number, are natives. Salaries run from $60 to $100 a month. Iron poles are used, on account of the scarcity of wood. The climate in Peru is exceedingly dry. The amount of battery necessary is quite small, compared with what is used in this country. In a circuit of 218 miles only eighteen cups of Grove battery are used, nine at each end. Mr. Mac Cord will not return to Peru for some little time, as the war in that country keeps business practically at a standstill.

LIGHT STANDARDS.—M. Monnier, director of the laboratory installed at Paris (by the gas companies) for the study of electricity, has undertaken a comparison of the existing standards of light. He finds the value of the French carcel to be in English standard candles 8.33, in German candles 7.5, in Munich candles 6.5. The standard equivalent values of those in vogue are for the English 9.5, and German 7.6; therefore some change in this respect would seem to be advisable. Schilling's equivalents to the carcel are English 9.6, German 9.8, and Munich 8.7. On the other hand, Schilling's measurements give the corresponding value as 7.77, 7.4, 8.7. There is thus room for a correct determination, and on the face of this disagreement between other observers some are the less inclined to trust to M. Monnier's results. It is high time some definite system of light standard was adopted. What is the Committee of the International Electrical Congress appointed to consider this question doing?

ELECTRICAL HEADLIGHTS.—The high praises and enthusiastic reception of the electric headlight on exhibition at Vienna, says *Mechanics*, need a word of explanation. The headlights in general use abroad are very different affairs from the very powerful lamps and reflectors used in this country for the same purpose. It is natural, therefore, when a brilliant light is secured, for the foreign engineers to be greatly surprised at the results obtained. From what we can learn of the light and its power, it is about equal to that of a first-class American headlight. The adaptation of the electric light, however, to the 24-inch reflector, would give a most brilliant and powerful light, and one which, on many accounts, would be better than that obtained from oil. Electric lamps of this kind have been made by the Brush Company for a variety of purposes. The great lights for military purposes, made by the company for the Japanese Government some months since, were essentially of this pattern.

THE ELECTRIC LIGHT IN LIGHTHOUSES.—For several years past preliminary experiments have been in process with the electric light in French lighthouses. The results are sufficiently satisfactory to the government to encourage a more extensive use of the electric light for this purpose, and of the 382 lighthouses which are scattered over various points along the French Atlantic and Mediterranean coasts, 42 will receive electric light installations immediately. The experiments made show that when provided with the electric light, the lighthouses on the English Channel and on the Atlantic coast will remain visible for at least ten months of the year, whereas with the present illumination they are scarcely visible for six months, owing to the prevalence of fogs. On the Mediterranean the electric light will render them visible for fourteen-fifteenths of the year. The lighthouses which are situated in the most dangerous points or at the principal ports are those which will receive the electric light first.

GREATER SAFETY FOR THEATRES.—The electric light was recently, says *The City*, the means of avoiding considerable danger at the Eden Theatre at Brussels. An oxhydric gas apparatus used for the lighting arrangements behind the scenes had exploded, and the air was so strongly affected by the explosion, that not a gas jet in the theatre was left burning. This was so far fortunate, as the gas continuing to escape, the slightest contact with a flame would have brought about a serious conflagration. The theatre was, therefore, plunged in complete darkness, and it was not possible to enter with a light for fear of an explosion. Luckily, electric, "Sun" lamps had been fixed in the theatre; they were lighted, and allowed the public to leave without panic. As these lamps are completely enclosed, there was no danger of their causing a catastrophe in the highly explosive atmosphere of the theatre. The Belgian press, consequently, urges the speedy adoption of the electric light in all theatres, and we can but echo this recommendation.

A LOCOMOTIVE HEADLIGHT.—An Indianapolis paper says: A new and brilliant electric headlight for locomotives is being quietly perfected in this city by a modest inventor who does not care to have his name made known until a public exhibition has placed it beyond the possibility of a failure. The light will equal that of 4,000 candles. At present a twenty-candle light is the best that can be produced. It will light the track for a mile brilliantly, and the light will be full and continuous. The generator or dynamo will be run by steam at the will of the engineer. It will be located opposite the air-brake, and will not take up as much room. By the same machine, depots, bridges, crossings and tunnels will be lighted. Extending along the track for half a mile in both directions will be an electric wire connected with the lamps in tunnels and bridges; then, extending downward from the dynamo on the engine, the brush will be arranged to touch the wire as soon as it is reached. This will light up the object ahead, and as soon as the brush leaves the wire on the other side, the light goes out. A public exhibition will be given soon.

BECOMING A SCRAP HEAP.—Mr. Gordon, in a recen lecture before the Society of Arts, gave some very amusing and also very interesting facts in regard to his immense dynamo machine, just completed, as well as in regard to one which had been previously built, and which, after a short and rather brilliant career, made a scrap heap of itself. The older machine, it appears, ran very successfully for a short time, and then began to develop signs of weakness and irregularity in motion. It seems that it was in a strong vault where its bursting could do little harm, so the inventor called the men into places of safety and watched to see what would happen. The speed was terrific, and the vibrations, which had been serious, began to grow worse and worse, till at last the metal let go, and the machine wrecked itself in a most extraordinary manner. Judging from the inventor's statement, the heaviest piece remaining did not weigh over 150 pounds. Mr. Gordon's principle of work is to produce a machine so large that it can be driven direct from an engine without the necessity of having a very high number of rotations per minute, the velocity being obtained from the large diameter of the ring containing the field magnets.

MISCELLANEOUS NOTES.

VISITING PHILADELPHIANS.—Mr. E. Ward Wilkins, of Messrs. Partrick & Carter, and Mr. W. T. Brown, electrician of the Pennsylvania Railroad, were in New York on Thursday.

INCREASE OF MANUFACTURING FACILITIES.—The Bridgeport Brass Co., Bridgeport, are erecting a new factory 150x35 feet, three stories and built of brick. This building is erected to accommodate their increasing business in the manufacture of electric light and telegraph wires.

A "HEAD OF MEDUSA" TRICK.—A stroke of lightning "banged" a Pennsylvania girl's hair as nicely as if it had been done with a pair of scissors. But this electrical style of "banging" is too "shocking" to become popular. The ordinary style of banging is shocking enough—to good taste.—*Norr. Herald.*

THE ELECTRIC LAUNCH AT VIENNA.—On Tuesday last

says the London *Electrician* of the 29th ult., the electric launch belonging to the Electrical Power Storage Company conveyed a distinguished party on the longest trip yet made in such a vessel. The launch started from Vienna, and followed the course of the Danube to Pressburg, a distance of about 50 miles, accomplishing the journey in four hours, or about 12½ miles an hour with the stream. This launch is the joint production of the above company, Messrs. Siemens Bros. & Co. and Messrs. Yarrow & Co.

ELECTRICITY AND THE LONDON MAYORALTY.—The cable has already informed us of Alderman Hadley's disappointment in connection with the chief magistracy of London, and the following item from the English *Electrical Review* tells how it happened: It is said that an organized opposition has been arranged in the city to oppose the proposed nomination to-day of Mr. Alderman Hadley as the Lord Mayor elect. Various reasons have been given to account for such a proceeding against this gentleman, who is well known in connection with the proposed new Atlantic cables. It seems to us that the true reason, although we have not seen it mentioned elsewhere, is to be found in this very matter, or in other words, it appears more than probable that the cables which should be at the bottom of the Atlantic are at the bottom of the opposition, which it is to be hoped will not prove successful.

ELECTRICITY, CABLES OR HORSES.—There will shortly be an opportunity in this city, says the San Francisco *Mining Press*, for a very interesting comparative test as to the relative merits of systems of street-car propulsion. The line which runs through the city on Mission street is about to adopt electricity as a motor, using storage batteries placed under the seats in the cars. On a parallel street one block away, with almost precisely the same grade, runs a new road on the underground cable system, having all the newest appliances and best equipment possible to procure. No expense has been spared in the construction of the road or its outfit, and it may be said to be a model in this respect. It runs at a higher speed than any other cable road in the city, and has heavy cars and dummies. Being the principal thoroughfare of the city, and in a thickly-settled portion, the cars carry heavy loads, especially in the mornings and evenings.

LO, THE POOR LINEMAN!—Two linemen of the American District Telegraph Company of this city were arrested on Wednesday on the roof of No. 2 Bond street, where they had gone to repair some wires without having first obtained permission from David Tetzlof, the owner of the premises. Mr. Tetzlof told Justice Duffy that he had been greatly annoyed by the telegraph linemen swarming upon his roof, despite wire fences, warnings and notices in the papers. He had been obliged to put a new roof on his building owing to the damage done by them. The prisoners said that one of the company's instruments was in an office of one of the tenants of the building, who gave them permission to go on the roof. This quasi permission saved them and they were discharged with a reprimand. Mr. Tetzlof asked what he should do with the wires, and Judge Duffy told him that he should give notice to the companies to remove them, and if they failed to do so within a reasonable time he then had the right to cut them down.

CABLE STOCKHOLDERS SUED.—Among the subscribers to the capital stock of the United States Underground Cable Company were Russell Sage, James R. Keene, State Senator John J. Kiernan, J. Gunzburg, E. L. Oppenheimer, H. Durand and John De Brot. In November, 1881, the company called on its subscribers to pay in 15 per cent. of their subscriptions. The persons named failed to pay. The company is now in the hands of a receiver appointed in a proceeding for its voluntary dissolution. A petition by the receiver, John H. Kitchen, for leave to sue the delinquent subscribers was presented to Judge Donohue in Supreme Court, Chambers, on the 29th ult. Leave was granted. Russell Sage subscribed for 1,000 shares at $100 each, and the sum for which he is to be sued by the receiver is $15,000; James R. Keene subscribed for 300 shares, and is to be sued for $5,500; John J. Kiernan subscribed for 200 shares, and is to be sued for $3,000. The other delinquents are to be sued as follows: G. J. Gunzburg for $3,000 on 200 shares; E. L. Oppenheimer for $1,500 on 100 shares; H. Durand for $1,500 on 100 shares, and John De Brot for $3,000 on 200 shares.

CHARACTERISTICS OF NEW INVENTIONS.—Like many other human activities the patenting of new inventions "breaks out in spots," remarks the Chicago *Journal of Commerce*. An example of this is found in the recent rapid issue of patents and applications for patents in a very few lines of invention. The first class to be mentioned, which indeed is the one that would be guessed by every intelligent reader of the newspapers of the day, is mechanism for the practical use of electricity. A new principle, such as that of converting sound waves to electrical waves on a wire, as exemplified in the telephone, brings after it numerous devices for its practical application. Every great invention is thus followed by a numerous train of subsidiary patents, usually dependent upon it, as all varieties of the sewing machine with their many "attachments" were dependent upon the device of a needle with the eye in the point. So the telephone, with ts improved transmitters, receivers, switch-boards and devices for "shunting," occupies a large share of the attention of the patent examiners.

TESTING A NEW RAILROAD SIGNAL.—On Oct. 3 the National Electric Railroad Signal Company entertained a large party of railroaders along the line of the Louisville & Nashville Railroad between Southall street Depot and Crescent Hill, Louisville, in exhibiting its improved apparatus now in operation there. Mr. Edward Fulton, president of the company, had invited railroad men from all parts of the country to see the test, and at half-past 3 o'clock a train pulled out from the Short Line Depot with a large crowd aboard. The apparatus is worked by the rails being charged with electricity, and two sides are shown on the signal posts—one clear and the other danger. When a train, single engine or hand-car enters upon the portion of the road through which the apparatus operates, the signals for two miles ahead show danger on both sides. At night the signals are illuminated and show the white and red lights. Everybody declared the success of the invention, and Mr. LeGrande, the inventor, was congratulated on all sides. After returning to the city President Fulton invited his guests to a lunch served at the Galt House.

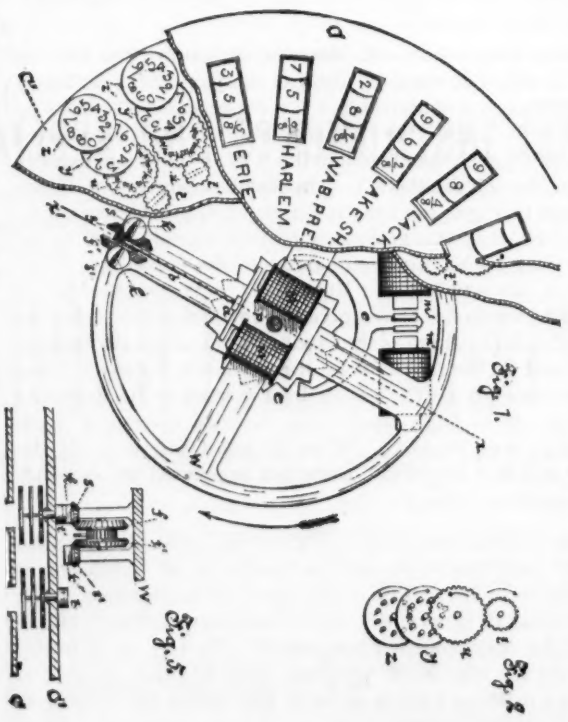
STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Wednesday of this week as follows:

	Oct. 4.	Oct. 10.
American Cable	63	63
Western Union Telegraph	79¾	79
Bankers and Merchants' Tel.	132	132¾
Commercial Telegram	102	111
Mutual Union Telegraph	....	17¾
American District Telegraph	26	26
American Rapid Telegraph	51	....
Bay State Telephone	....	99½
Mexican Telephone Co.	2¼	2⅛
National Bell Telephone of Maine	....	70
New York and Pennsylvania	....	88
Boston & Northern Telephone	....	100
Overland Telephone	12	....
Surburban	....	100
Erie Telephone	....	50
People's Telephone (New England)	6¼	....
New York and New Jersey	93	94
Daft Electric	....	112
Brush Electric Light	....	97
Edison Electric Illuminating	50	50
Edison Electric Light	140	...
U. S. Electric Lighting	130	120
Electric Railway of United States	70	70
American Bell Telephone	221	205
Shaw Telephone	....	30
Solenoid Telephone	125	....

ELECTRICAL PATENTS ISSUED

And Dated Oct. 2, 1883.

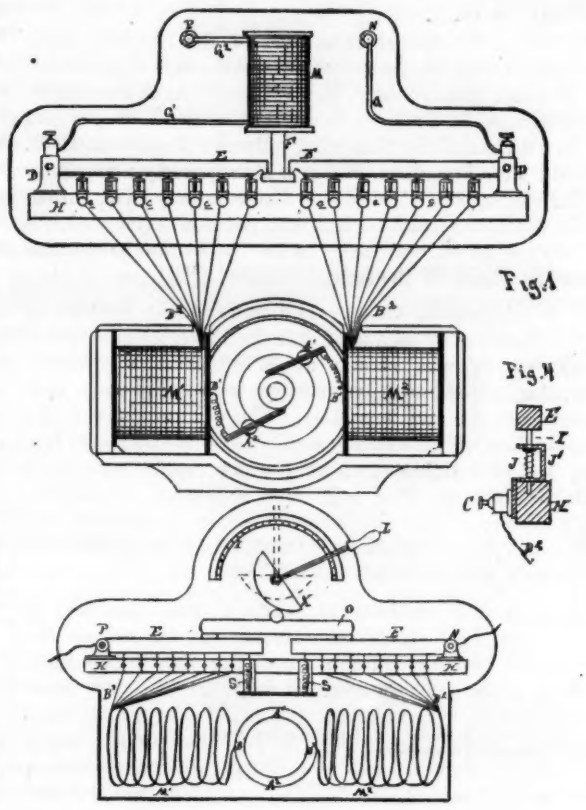
Automatic electric-circuit changer; Charles J. Van Depoele, Chicago, Ill. ... 285,859
Automatic electrical railway-signal; Daniel H. Applegate, Red Bank, N. J. ... 285,944
Stock indicator; Bradley A. Fiske, New York, N. Y. ... 285,805



The invention provides for a new method of reporting stocks to brokers. Instead of the species of printing telegraph known as "tickers" the inventor proposes to use a disc having the names of the stock disposed radially with a slot in a line with each name through which the figures of a mechanical counter, such as those used in gas-meters, etc., appear and are made to vary according to the change in market value of the stock.

The armatures of the stationary magnets *m' m'* are polarized and move under the influence of alternating currents. The escape wheel *e* attached to the largest wheel *W* moves under the influence of the escape-pallet *e'* to which the armatures of *m' m'* are attached. The transmitter in the central office is merely an index or pointer moved by hand, and as it moves it causes the current of the main battery to be alternated so that the wheels *W* follow the step-by-step motion. The magnet *M M* moves with the wheel *W*. It is included in the circuit, but only attracts its armature when a stronger current is sent through the line from a special battery. To the armature is attached a rod *a b* which causes a ratchet wheel placed on the rim of *W* to move one tooth each time an impulse from the strong battery is sent. This ratchet wheel moves two small bevel wheels *f f'* (Fig. 5), which engage smaller wheels *s s'*. The latter move one-half a revolution with each motion of the armature. They each carry a projecting blade *k k'* like the point of a screw driver, which is normally in a line with the circumference of the wheel *W*. As the wheel *W* moves around step by step these blades pass through slots in the first wheel *t t'* of the counter. When the stock piece indicated is to be increased the wheel *W* is made to stop at such a point that the screw-driver *K* is in the slot of the first wheel of the counter. Then on passing a stronger impulse of current the magnet *M M* causes the motion of the driver *K* and the stock is increased one-eighth, or whatever fraction constitutes the lowest step. If the wheel *W* has been so controlled from the central office that it the driver *K* into the slot, then each motion of the armature *a* causes a decrease of the indicated value of the stock, since the motion of the counter would be reversed.

Electric motor; Charles J. Van Depoele, Chicago, Ill. ... 285,857



The invention has reference to a method of regulating the operation of electric motors so as to maintain uniformity of speed under variations of current or of load. The field magnets M^1 M^2 are wound with several parallel strands of wire made into a cable. The strands are all distinct and insulated from each other, but connected in common at B^1 B^1 to the brushes A^1 A^2. The outer ends of the strands separate to go to a kind of switch-board. The binding posts *c c c* in the bar of insulating material *H* are in contact with metallic bent strips *J'* (Fig. 4), through which passes a vertical rod *J* having a collar and surrounded by a spiral spring, whereby it is impelled upward and tends to hold the contact bars *E E* pivoted at the binding posts *D D* from swinging down into contact with the metallic strips *J'*. In Fig. 1 the main circuit from the terminals of the source of current *P N* includes an electro-magnet *M*, whose armature *F* supports the bars *E E* when the proper amount of current is passing through *M*. In the normal condition only a few of the strands of the cable are in circuit, but when the current weakens, the armature *F* falls and the bars *E E* come down into contact with a larger number of the metallic strips, thereby increasing the number of strands included in circuit, and at the same time increasing the magnetic power of the field magnets M^1 M^2. As it is sometimes desirable to control the operation of the motor at will, a device *L K* (Fig. 2) may be used to cause the bar *E* to make contact at will.

Electric switch; Wellington Adams, St. Louis, Mo., assigned to the Adams Electric Company, same place. ... 285,778
Electric mattress-spread; Rickason Stilwell, New York, N. Y., assignor, by direct and mesne assignments, to Bradford Wellard and Emeline C. Stilwell, both of same place. ... 285,854
Electric galvanic mattress; Rickason Stilwell, New York, N. Y., assignor, by direct and mesne assignments, to Bradford Wellard and Emeline C. Stilwell, both of same place. ... 285,852
Electric railway; Charles J. Van Depoele, Chicago, Ill. ... 285,858
Electro-medical appliance; James W. Dennis, Cincinnati, Ohio, assignor to Clara E. Dennis, same place. ... 285,977
Electrical conductor for oil-tanks, Henry W. Spang, Reading Pa. ... 286,086
Electric lamp; Charles J. Van Depoele, Chicago, Ill. ... 286,093
Electric-arc lamp; Charles J. Van Depoele, Chicago, Ill. ... 286,094
Electric-arc lamp; Richard R. Moffatt, Brooklyn, N. Y. ... 286,144
Electric cut-off; John A. Tupper, Salt Lake City, Utah. ... 286,158
Fire-alarm; Robert S. Finch, Cincinnati, Ohio. ... 285,983
Globe for incandescent electric lamps; Geo. P. Bartlett, Woburn, Mass. ... 285,784
Insulation of wires for telegraph-lines; Thomas J. Mayall, Reading, Mass. ... 286,035
Insulated electric conductor; Thomas. J. Mayall, Reading, Mass. ... 286,036
Magneto-electric generator; Mahlon S. Conly, Indianapolis, Ind., assignor of one-half to William M. Cronyn, same place. ... 285,799
Means for applying electrical or galvanic currents to beds, couches, etc.; Rickason Stilwell, New York. N. Y., assignor, by direct and mesne assignments, to Bradford Willard and Emeline C. Stilwell, both of same place. ... 285,853
Plantés secondary battery; St. George Lane Fox, London, England. ... 285,807
Portable circuit-closer for electric alarms; Alvah Wiswall, Cincinnati, Ohio, assignor of one-half to Mathew Britton, same place. ... 286,100
Telegraphic repeater; William E. Athearn, Philadelphia, Pa. ... 286,107

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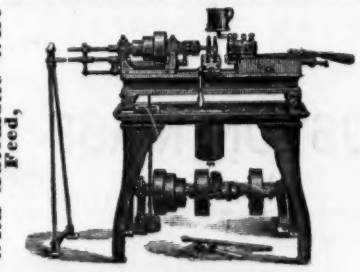

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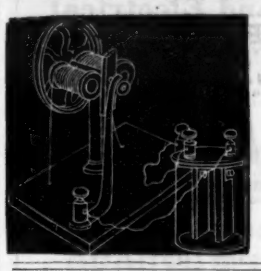

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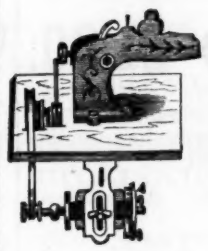

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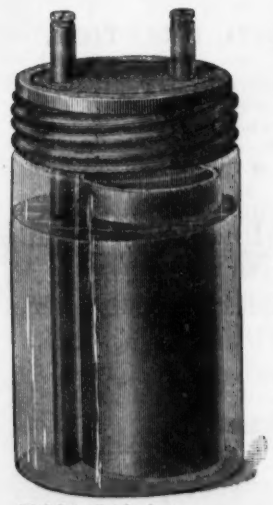

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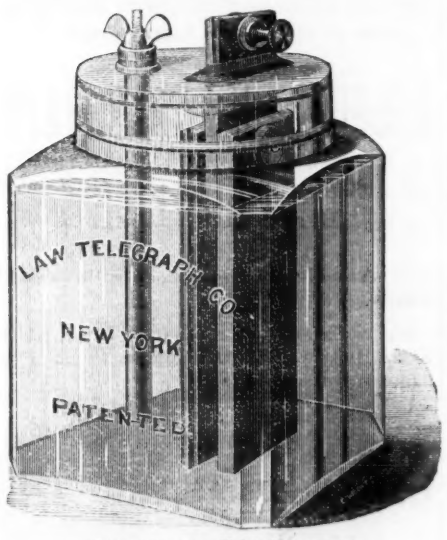

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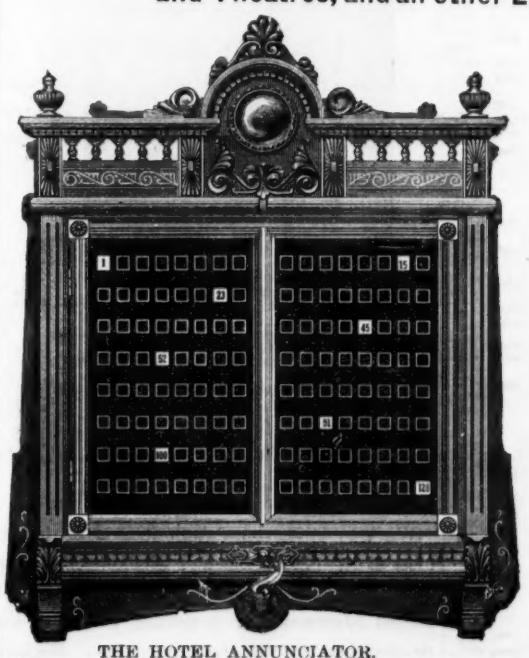

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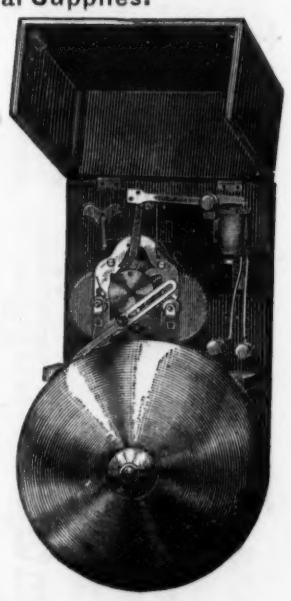

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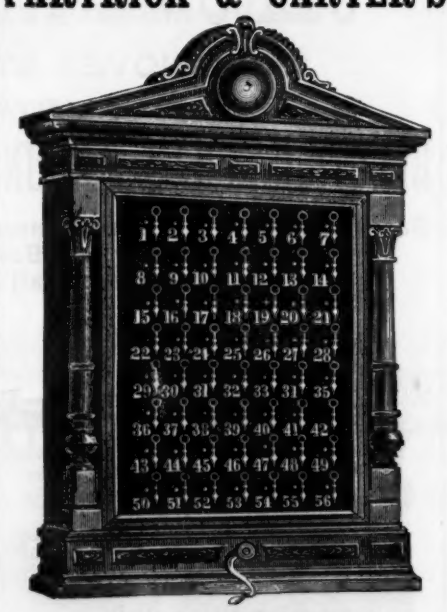

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This company, in connection with its present affairs, will continue the business of the late firm of

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Heretofore pertaining to Davis & Watts, and will henceforth give his personal supervision to the manufacture of electrical goods of every description.

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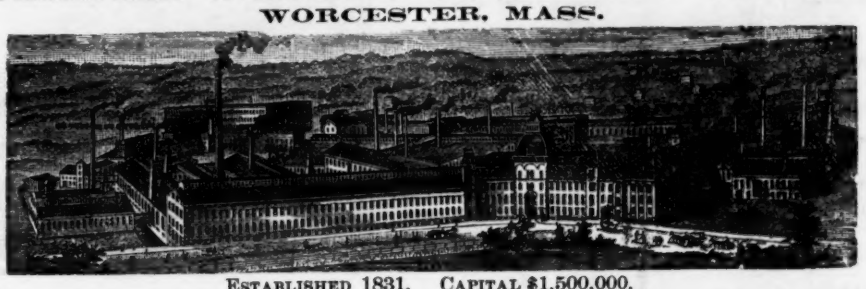

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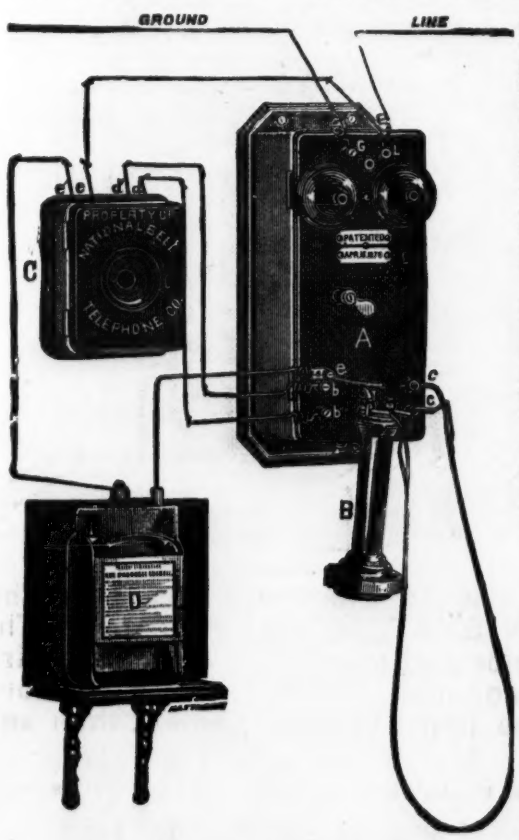

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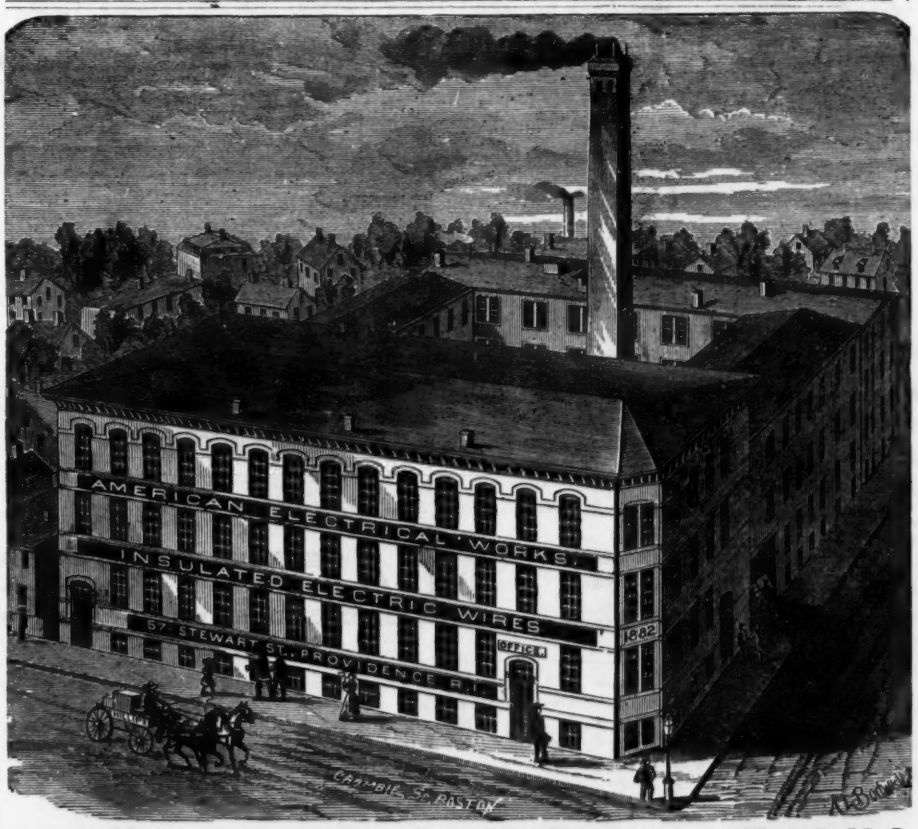

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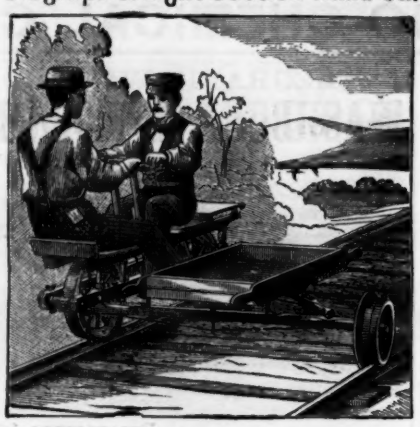

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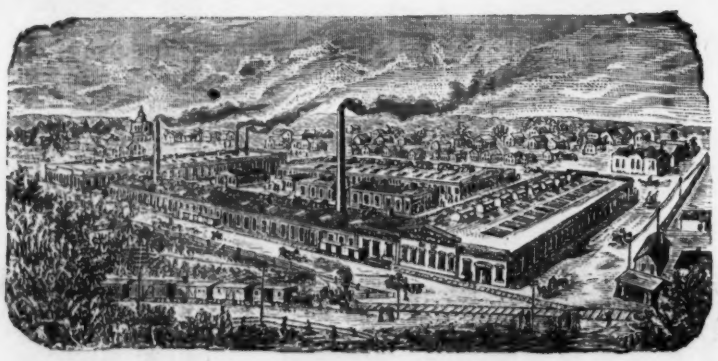

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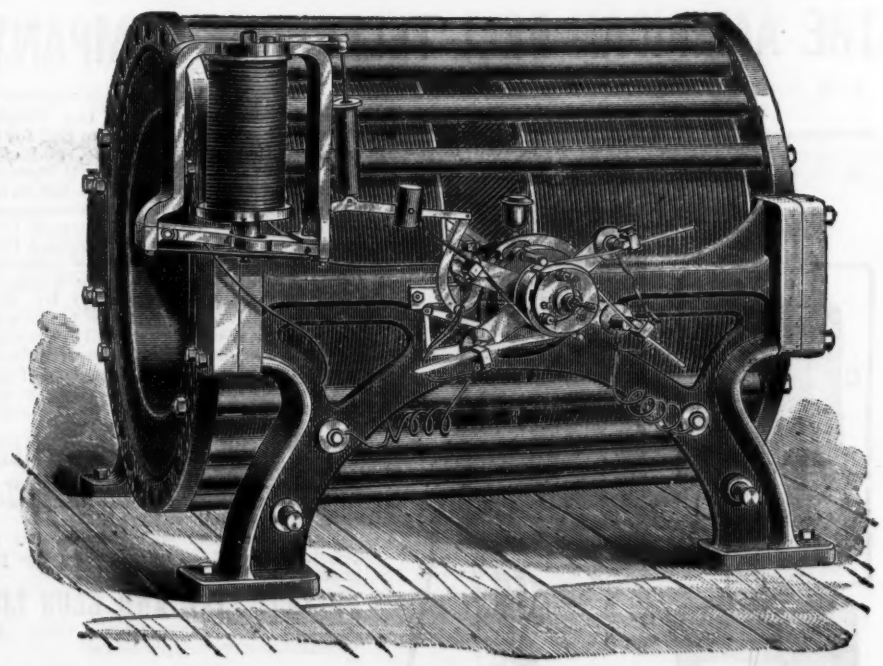

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